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CATECHISM OF THE LOCOMOTIVE.

By M. N. FORNEY, Mechanical Engineer.

PART XI. (CONTINUED.)

THE RUNNING GEAR.

QUESTION 259. How are the driving wheels of locomotives constructed?

Answer. They are made of cast iron with wrought-iron or steel tires around the outside. Fig. 161 represents a perspective view of a pair of locomotive wheels and axle. The central portion of the wheel, that is the hub spokes and rim, are cast in one piece. Usually the hub and the rim, and sometimes the spokes, are cast hollow. The central portion of the wheel, that is the part which is made of cast iron, is called the wheel center.

axles, and the latter are turned off so as to fit the hole bored in the wheel. The axles are then forced into the wheel by a powerful pressure produced either with a hydraulic or screw press, made for the purpose. In order to prevent the strain upon the crank-pins from turning the wheels upon the axle, they are keyed fast with square keys driven into grooves cut in the axle and in the wheel to receive them.

QUESTION 263.—How are the crank-pins made?

Answer. They are made of wrought iron or steel, and accurately turned to the size required for the journals for the connecting rods. Fig. 164 represents one of the main crank-pins, and fig. 163 back pin. The main pin has two journals, one, A, to which the main connecting-rod is attached, and the other, B, receives the coupling-rod. The back pin has only one journal, A, for the coupling-rod.

QUESTION 264.—How are the crank-pins fastened to the wheels?

Answer. They are turned so as to fit accurately holes which are usually "straight" or cylindrical and bored in the wheels. The pins are then either driven in with blows from a heavy weight swung from the end of a rope, or else pressed in with a screw or hydraulic press. Sometimes the holes are bored tapered or conical and the pins turned to the same form. They are then ground in with emery and oil, so as to fit perfectly, and are secured by a large nut and key on the inside of the wheel.

QUESTION 265. What are the pieces A, A, fig. 161 between the spokes of the wheel for?

QUESTION 269. How are the boxes, journals and journal-bearings of the truck wheels made?

Answer. They are very similar to those for the driving wheels, their chief difference being that those for the truck wheels are smaller than those for the driving wheels.

QUESTION 270. How are the frames for locomotives constructed?

Answer. The frames, H H, figs. 40, 41 and 42, are made of bars of wrought iron from 3 to 4 inches thick and about the same in width. They are usually made in two parts, the one at the back part of the engine, to which the driving-boxes and axles are attached, and the other at the front end, to which the cylinders are bolted. The back part, or main frame, as it is called, is represented in fig. 168, and consists of a top bar, H H, to which pieces, a a' b b', fig. 169, called frame-legs, are welded. Two of these form what is called a *jaw*, which receives the axle-box, as shown in fig. 169. To the bottom of each jaw a *clamp*, c, is bolted to hold the two legs together. The two legs, a and b', are united by a brace, d d, welded to the bottom of the legs. A brace, m, unites the back end of the frame with the leg b, and is welded to each.

The front part of each frame consists of a single bar, e, which is bolted to the back end, as represented in figs. 168 and 169, which show the construction clearer than any description would. These front bars extend forward to the front end of the engine, and a heavy timber, called a *bumper-timber*, E E, figs. 40, 41 and 42,* extends across from one to the other and

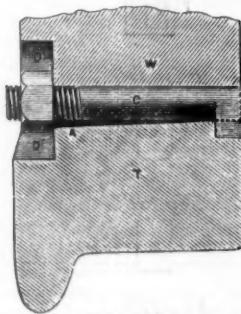


Fig. 162.

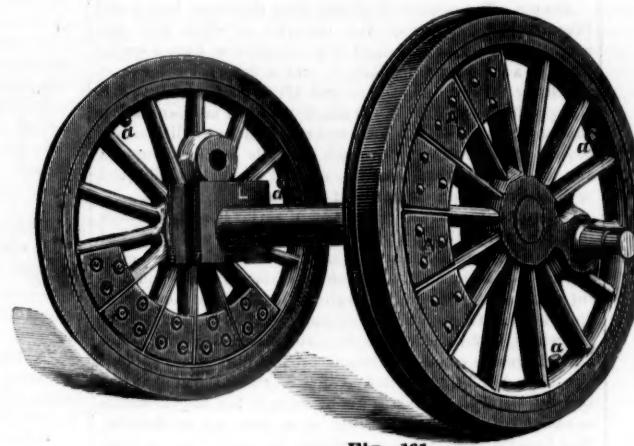


Fig. 161.



Fig. 166.

Fig. 167.

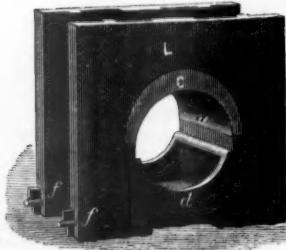


Fig. 165.

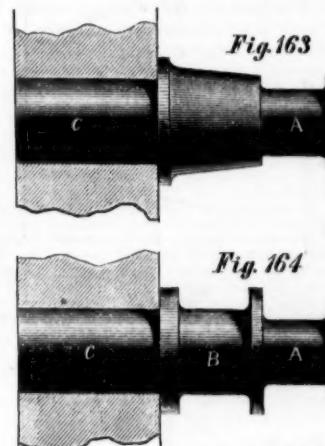


Fig. 163

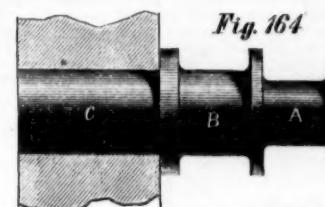


Fig. 164

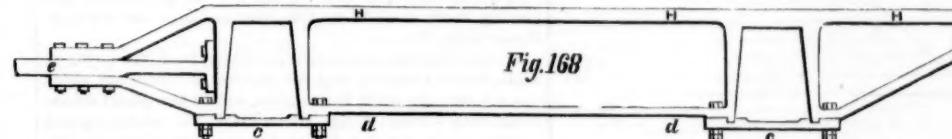


Fig. 168

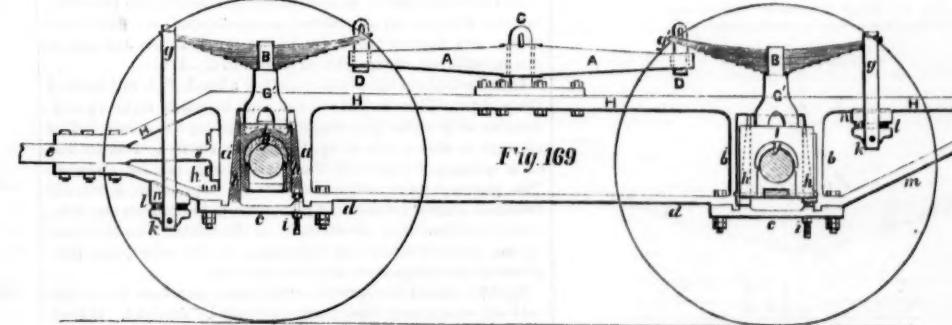


Fig. 169

QUESTION 260. How are the tires fastened on the wheel-centers?

Answer. The insides of the tires are usually turned out somewhat smaller than the outside of the wheel-center. The tire is then heated so that it will expand enough to go on the centre. It is then cooled off, and the contraction of the metal will fit it firmly around the cast-iron part of the wheel. As an additional security bolts or set-screws, a, a, fig. 161, are screwed through the rim and into the tire to prevent it from slipping off in case it becomes loose. In some cases the wheel center and the inside of the tire are turned conical, and the tires are then put on cold and held on with hook-headed bolts, C, as shown in fig. 162, which is a section of the tire and the rim of the wheel. The wheel-center is made largest on the inside. As the strain against the flange of the tire is inwards, the cone of the wheel-center resists this strain. If it is curved or tapered the reverse way, the strain would come on the bolts. This method of putting on tires has the advantage that they can be removed quickly and without heating the tires.*

QUESTION 261.—Are there any standard sizes for the inside diameters of tires?

Answer. Yes. To avoid the great inconvenience arising from the diversity in the inside diameters of tires, the American Railway Master Mechanics' Association has recommended that the inside diameter of tires should be made 36, 40, 44, 50, 56 and 62 inches. The thickness for the first three sizes to be 3 in. and the last three 2 1/2 in.

QUESTION 262.—How are the driving-wheels fastened on the axles?

Answer. The hubs are accurately bored out to receive the tires. This method of putting on tires is used exclusively on the Baltimore & Ohio Railroad.

Answer. They are called counterbalance weights, and are put in the wheels to balance the weight of the crank-pins, connecting rods and pistons. The principle of their action will be explained hereafter.

QUESTION 266. On what part of the axle does the weight of the engine rest?

Answer. It rests just inside and close to the wheel.

QUESTION 267. What are the driving-axle boxes?

Answer. They are cast-iron blocks, L, fig. 161, which embrace the axle. Each has a brass bearing, c, fig. 165, which rests on top of the axle. Fig. 165 is a perspective view of a driving-box which shows what is called the oil-cellars, d. This is a receptacle underneath the axle which is filled with wool or cotton waste and saturated with oil for the purpose of lubricating the axle. The oil cellar is held in its position by two bolts, f, f, which pass through it and the driving-box casting. By removing the bolts the oil-cellars can easily be removed and the box can then be taken off the axle.

QUESTION 268. How are the truck wheels made?

Answer. They are made of cast iron, usually in one piece. Figs. 166 and 167 represent sections of two forms of wheels used for cars. Those used for locomotive trucks are similar to these, excepting that they are usually a little smaller in diameter. They are made with a disc or plate which unites the tire to the hub, and in some cases they have ribs cast in the inside, as shown in the two figures. The tread of the wheel is hardened by pouring the melted cast iron into a mould of the form of the tread of the wheel. The mould is also made of cast iron, but being cold cools the melted iron very suddenly, and thus hardens it somewhat as steel is hardened when it is heated and plunged into cold water.*

* It should be mentioned here that it is only certain kinds of cast iron which will be hardened in this way, or will "chill," as it is called. The cause of this chilling is not known.

is bolted to each of them. This timber is intended to receive the shock or blow when the locomotive runs against any object, such as a car. The *cow-catcher* or *pilot*, S, is fastened to this timber.

The front bar of the frames also has usually two lugs or projections forged on it, between which the cylinders are attached. The latter are securely held in their position by wedges, which are driven in between the lugs and the cylinder castings.

The frames, as already stated, are made of wrought iron and are accurately planed off over their whole surface.

QUESTION 271. How are the frames fastened to the boiler?

Answer. As already stated, they are fastened to the cylinders with wedges and bolts, and as the cylinders are bolted to the smoke-box the frames are thus rigidly attached to the front end of the boiler. In order to strengthen those portions of the frames which extend beyond the front of the smoke-box and to which the bumper-timber is attached, diagonal braces, r' r', fig. 40, 41 and 42, are bolted both to the timber and to each of the frames at their lower ends. The upper ends are bolted to the smoke-box. Other braces, d', fig. 41, are also fastened to the frames and to the band of the boiler. The frames are fastened to the fire-box by clamps, I, L, fig. 40, called *expansion clamps*. These clamps embrace the frames so that the latter can slide through the former longitudinally. There are also usually two diagonal braces not shown in fig. 41, the upper ends of which are fastened to the back end of the shell of the fire-box at about the level of the crown-sheet, and the lower ends to the back ends of the frames. There are also usually transverse braces attached to the lower part of the frames, thus uniting the two together. The guide-yokes, j, j, fig. 40, are also usually bolted to the frames and to the boiler. In

* There figures were published in the GAZETTE of June 27.

many cases one only is used, which extends across from one frame to the other and is fastened to the boiler.

QUESTION 272. *Why are the frames attached to the shell of the fire-box so as to slide longitudinally through the fastenings?*

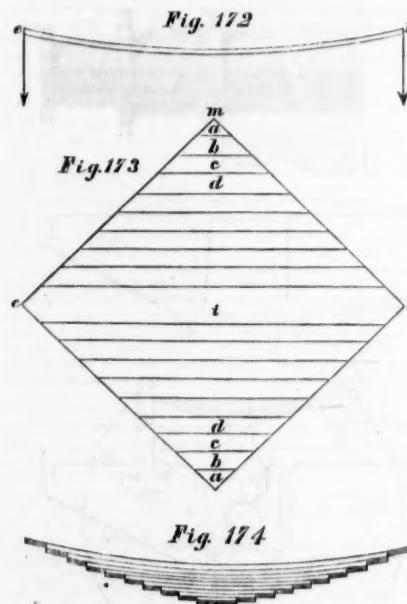
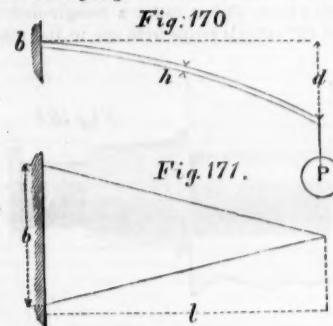
Answer. Because when the boiler becomes heated it expands, and if it could not move independent of the frames its expansion would create a great strain on both itself and the frames. The fastenings to the fire-box are therefore made so that the frames can move freely through them lengthwise but in no other direction.

QUESTION 273. *How much more will the boiler expand than the frames in getting up steam?*

Answer. From $\frac{1}{4}$ to $\frac{5}{16}$ of an inch.

QUESTION 274. *Why is it necessary to support the engine on springs?*

Answer. *Because, however well a road may be kept up, there will always be shocks in running over it; these occur at the rail joints and especially when the ballasting of the ties is not quite perfect. These shocks affect the wheels first, and by them are transferred through the axle-boxes to the frame, the engine and the boiler. The faster the locomotive runs, the more powerful do they become, and therefore the more destructive to the engine and road, and consequently the faster a locomotive has to run the more perfect should be the arrangement of the springs.



If we strike repeatedly with a hammer on a rail, the latter is soon destroyed, while it can bear without damage a much greater weight than the hammer lying quietly on it. The axles, axle-boxes and wheels strike like a hammer on the rails at each shock, while the shock of the rest of the parts of the engine first reaches and bends the springs, but on the rails has only the effect of a load greater than usual resting on them. Another comparison will make still plainer the lessening by the springs of the injurious effect which the weight of the boiler, etc., exercises on the rails.

A light blow with a hammer on a pane of glass is sufficient to shatter it. If, however, on the pane of glass is laid some elastic substance, such as india-rubber, and we strike on that, the force of the blow or the weight of the hammer must be considerably increased before producing the above-named effect. If the locomotive boiler is put in place of the hammer, the springs in place of the india-rubber, and the rails in place of the glass, the comparison will agree with the case above. From this consideration it will be seen how important it is to make the weights of the axles, axle-boxes and wheels as light as possible.

QUESTION 275. *How are the driving-axle boxes arranged so that the weight of the engine will rest on springs?*

Answer. They are arranged so as to slide up and down in the jaws. Springs, *B B*, fig. 169, are then placed over the axle-boxes and above the frames. These springs rest on *fl*-shaped saddles, *G' G'*, which bear on the top of the axle-boxes. The frames are suspended to the ends of the springs by rods or bars, *g g', g' g*, called *spring-hangers*. As the boiler and most

of the other parts of the engine are fastened to the frames, their weight is suspended on the ends of the springs, which, being flexible, yield to the weight which they bear.

QUESTION 276. *How are the frames protected from the wear of the axle-boxes which results from their sliding up and down in the jaws?*

Answer. The insides of the legs, *a, a', b, b'*, are protected with *shoes* or *wedges*, *h, h'*, which are held stationary, and the box slides against the faces of the shoes, thus wearing the shoe or wedge but not the frame.

QUESTION 277. *Why are the shoes usually made wedge-shaped?*

Answer. They are made in that way so that when they become worn, by moving them up in the jaws, the space between them is narrowed and the lost motion is taken up. They are moved by the screws *i, i'*. If the boxes should become loose from wear, it would cause the engine to thump at each revolution of the wheels, or stroke of the piston.

QUESTION 278. *How are the springs for the driving-wheels made?*

Answer. They are made of steel plates which are placed one on top of the other. These plates are of different lengths, as shown at *B, B* in fig. 169, and are from 3 to 4 in. wide and $\frac{5}{16}$ to $\frac{7}{16}$ thick. The length of the springs measured from the center of one hanger to the center of the other is usually about three feet.

QUESTION 279. *What determines the amount which a spring will bend under a given load?*

Answer. The number of plates, their thickness, length and breadth, and of course the material of which they are made. This can be explained if we suppose we have a spring plate of a uniform thickness, *h*, and a triangular form, of which fig. 170 is a side view and 171 a plan, and that it is clamped fast at its base, *b*. It is a well known mechanical law that any material of this form and under these conditions will have a uniform strength through its whole length to support any load, *P*, suspended at its end, and also that it will bend or deflect in the form of an arc of a circle.

In locomotives the arrangement of springs is always such that they are either supported in the middle and moved at the two ends, or such that they are supported at the two ends and loaded in the middle; for our consideration it is indifferent which of the two kinds of springs is taken for the present illustration. That shown in plan and elevation in figs. 172 and 173, which is formed of a wide plate placed diagonally, and which in reality consists of two such triangular pieces as were represented in fig. 171 united at their bases and loaded at two opposite corners, *e* and *f*, would answer the requirements mentioned if the great breadth, *m m*, were not an obstacle. This breadth is obviated by cutting the spring into several strips, *a a, b b, c c, d d, ..., i i*, fig. 173, of equal width, and placing these not side by side, but one over the other, as shown in fig. 174.

In order that the separate strips and layers of the spring so made, figs. 174 and 175, may not slip out of place, the strips *a a, b b, etc.*, are made in one piece, and all the plates are inclosed with a strap, *F*, figs. 176 and 178. The plates, instead of being cut from a piece like that represented in fig. 173, are, however, made out of steel of the proper width, and the ends, instead of being cut off pointed as represented, are sometimes drawn out thinner on the ends like the point of a chisel, or often still cut off straight, as shown in fig. 178.

In order to hold the plates together a band, *F*, is put around the middle. This is put on hot, and becomes tight by contracting as it cools. The center of the spring has a hole drilled through it with a pin, *s*, fig. 177 (which shows a cross section of a spring), to prevent the plates from sliding endwise. The plates at each end usually have a depression, *a*, fig. 179 (which is a cross section of a plate), made in them on one side, and a corresponding elevation, *b*, on the other. The elevation on one plate fits into the depression on the other, and thus prevents the plates from slipping sideways.

Springs should be curved so that when they bear the greatest load which they must carry they will be straight. If they are curved too much they are subjected not only to a strain which bends the plates, but to one which has a tendency to compress them endwise. Thus if a spring like that represented in fig. 180 is bent into a half-circle, it is obvious that the strain at the ends has no tendency at all to bend it, but only to compress it. Near the middle the strain will of course bend the spring. In the one direction the spring is flexible and elastic, and in the other it is not; and as the strain of compression depends on the amount of curvature, the greater the latter is, the less flexibility and elasticity the spring will have.

Springs are often given a double curve, as shown in fig. 181. This is not to be recommended, because when a spring bends the plates must slide on each other. If they have but a single curve, they will do so and remain in contact through their whole length, but if they have two curves they will separate and therefore "gape," as it is called.

QUESTION 280. *What is meant by the elasticity of a spring?*

Answer. It is the amount which a spring will deflect or bend under a given load without having its form permanently changed. If the bending is so great that the spring does not recover its original form when the load is removed, then the strain to which it is subjected is said to exceed the limits of elasticity, and if repeated often it will ultimately break the spring.

QUESTION 281. *What is meant by the elastic strength and the ultimate strength of a spring?*

Answer. The elastic strength is the strain it will bear without being strained beyond the limits of elasticity, and the ultimate strength is the strain which will break it.*

QUESTION 282. *What determines the strength of a spring?*

Answer. It depends of course (1) upon the material of which the spring is made; (2) its strength increases in proportion to the number of plates; and (3) to their width and (4) in proportion

to the square of their thickness, and (5) as the length diminishes.

Thus if we wanted to double the strength of a spring like that shown in fig. 170 and 171, it could be done in either of the following ways: (1) by making it of material twice as strong; (2) by putting another plate just like it on top; (3) by doubling the width of the base *b*, which would make the strength of the whole plate twice what it was before; (4) by making the whole plate about four-tenths thicker, which would increase its strength, as already stated, in proportion to the square of the thickness as $1.4 \times 1.4 = 2$ nearly; by reducing the length to one-half what it is in fig. 170.

QUESTION 283. *What determines the elasticity of a spring?*

Answer. (1) The material of which it is made; with the same material the elasticity increases (2) as the number and (3) as the width of the plates diminishes, (4) with the cube of the length and (5) decreases with the cube of the thickness of plate.

Thus supposing the plate in figs. 170 and 171 to be $\frac{1}{8}$ in. thick and the deflection $d \frac{1}{2}$ in. (1) If it were made of material twice as stiff, or (2) with two such plates, or (3) with one twice as wide at the base, the deflection would be only $1 \frac{1}{4}$ in. If (4) the length were doubled, the deflection would be equal to $2 \times 2 \times 2 = 8$ or the cube of the length, or eight times what it was before. If (5) the thickness were doubled,

Fig. 177.



Fig. 176.

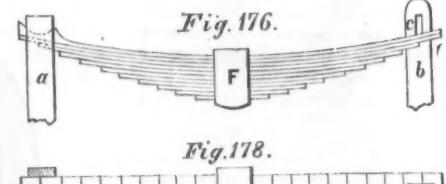


Fig. 178.



Fig. 179.

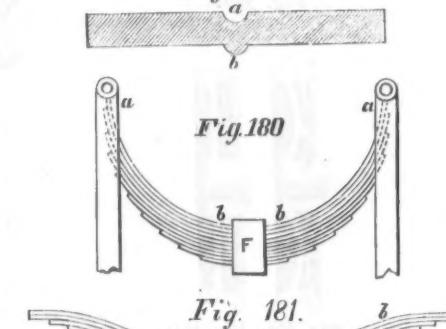


Fig. 180.

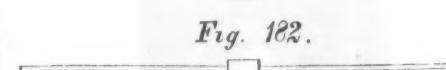


Fig. 181.



Fig. 182.

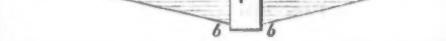
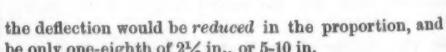


Fig. 183.



the deflection would be reduced in the proportion, and would be only one-eighth of $2 \frac{1}{2}$ in., or 5-10 in.

QUESTION 283. *What should be the proportion of the plates of a spring in relation to each other?*

Answer. The lower plates should diminish regularly in their lengths. The reason for this will be apparent from the fact which has already been stated that if a triangular plate of uniform thickness is clamped fast at its base, it will, if loaded at the end, be of uniform strength throughout its whole length. It is immaterial what the length of the base of such a triangle is, if the two sides are of equal length and its thickness uniform, not only its strength but the amount of deflection or bending from any load will be the same all through its length. If, therefore, we make a spring by cutting a plate formed of two such triangular pieces united at their bases into strips, as has already been explained, evidently the spring made of them will have a uniform strength throughout its whole length. As the strips thus made diminish in length regularly, it is evident that if the spring plates are made of steel rolled of the requisite width, their length should be the same as that of those cut from the plate referred to above. When this is the case the lower outline, *a b b a*, fig. 182, of the spring will, when the spring is not bent, be straight lines. In drawing springs, therefore, it is best to lay them out with the plates straight, and after determining the thickness, drawing a straight line from the strap to the end of the longest plate will give the form of the spring and the length of each of the plates. It is necessary, however, to put a sufficient number of long plates in each spring to give it the required strength next to the attachment of the hanger. Sometimes one or more of these long plates are made heavier than the rest. The evil of this method

* The above answer and much of the material referring to springs has been translated from "Die Schule des Locomotivfahrers," by Messrs. T. Brodius and R. Koch.

* This was fully explained in the answer to Question

of construction will be apparent if it is remembered that the greatest permissible deflection up to the breaking of the spring decreases with the *cube* of the thickness of the plate and its strength increases with the *square* of the thickness. Now if we have a spring with say ten plates $\frac{1}{8}$ in. thick and one on top $\frac{1}{4}$ in. thick, the thick plate will have a strength four times that of the thin plates, but its elasticity will be only one-eighth that of the thin plates, and therefore it will require eight times as much load to bend it any given distance as is needed to bend the thinner plates the same distance. But its strength is only four times that of the thin plates, so that for any given amount of elasticity the thick plate must bear twice as much load as it has strength to carry. This shows what a great mistake is committed if some of the plates are made thicker than others, a conclusion which is supported by practical experience, as it is found that if the top plates are made thicker than others the thick ones break most frequently, which is the necessary result of the supposed strengthening by increasing the thickness of the top plates.

Contributions.

Testing an Old Boiler.

LOUISVILLE, Ky., June 1, 1874.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following article in regard to testing the strength of an old locomotive boiler is sent you thinking it may be of some interest to many readers of your excellent paper. The boiler experimented upon belonged to Engine No. 208 owned by the Louisville & Nashville & Great Southern Railroad Company, and is about fifteen years old. The waist or cylinder part of the boiler is 48 inches in diameter by 11 feet long; the furnace end of boiler is "wagon-shape," 50 inches wide by 60 inches long, and rises 10 inches above the top of cylinder part of boiler. The shell of boiler is 5-16 of an inch thick, and all the seams are single-riveted. The engine has been in constant use, first for several years in the passenger service, then in the freight service, and for the last three years was employed as a switch engine. For the last two years the steam pressure has been limited to 80 pounds to the inch, after which the boiler was considered unsafe and condemned. The Superintendent of Machinery, Thatcher Perkins, Esq., in order to ascertain the ultimate strength of the boiler, determined to test its strength to the utmost limit by hydraulic pressure, and for the purpose employed a hydrostatic pump with piston 1 $\frac{1}{2}$ inches diameter and 5 inches stroke. When a pressure of 265 pounds to the inch was put on the boiler, it increased the circumference of the cylinder part 9-32 of an inch; all the seams at this pressure remained perfectly tight and showed no sign of weakness. A large patch of boiler-plate, 12x30, that had been put on each side of the boiler (several years since) where the cylinder boiler joins the furnace did not leak with this pressure, showed no appearance of weakness whatever, and proved as strong as any part of the boiler. Some arrangements having to be made before the final bursting pressure could be applied, the experiment was deferred for another occasion. Of the result of this you will be advised.

CORRESPONDENT.

Increase in Freight Tariffs.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In their second report the Massachusetts Commissioners urged on the railroad companies of that State the policy of a general reduction of rates and especially on raw material; they gave prominence to the statement that in Belgium the Government had adopted that policy in regard to freight with gratifying results during the eight years 1856 to 1864, at which latter date a similar move was made in passenger rates.

In view of this statement the article copied in the RAILROAD GAZETTE from *The Moniteur des Intérêts Matériels* of May 24, on the "Increase in Freight Tariffs in Germany," is interesting. It appears that in Germany, although the receipts per mile have increased in the period 1867 to 1873, the rates of labor and cost of materials having increased in greater ratio, the net receipts have steadily diminished, so that a rise of 20 per cent. in the tariffs will not increase the average dividends from 4.1 to 5.5 per cent. The allusion to Belgium is vague, but it appears that that country will not place any obstacles in the way of increasing the through rates.

If my information is correct, which I believe it to be, the reduction policy of the Belgian Government did not prove a success. It was not followed by the independent companies, and in 1868 the State, conceding that the experiment had been carried too far, modified the merchandise tariff and in 1871 modified the passenger tariff. It would appear now from the article above referred to that another increase in rates is imminent.

I call attention to these facts because it appears to me that the great outcry for "low rates" may in the sad state of competitive insanity, endemic among railroad companies, be productive of an attempt to do business at rates which cannot afterward be raised without causing a greater outcry than preceded them, and which may lead to disastrous results.

"Lower rates" is a cry that shall never cease, because rates can never be too low for those who are using the rail at the time being. It may be stated as an aphorism that the demand for lower rates and greater speed increases in geometrical proportion to the attempt to satisfy the demand.

The cry for lower rates and the attempts to satisfy that complaint are fraught with danger. Calculations based on the future by the most astute minds are almost as likely to prove wrong as right. Rates of labor and cost of material will not decrease and may increase suddenly in any year. If by increased knowledge the cost of transportation can be

reduced, renewals will yet present a frightful figure. It seems to me that there is some danger of our adopting as true the fallacy that a very great increase of traffic causes only a small increase of expenses. When rates have fallen to zero they can only be raised by combination, which, however necessary to the well-being of the community, will certainly cause a commotion as great as now exists.

H. E. S.

Expenses of Management.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It appears from the note at the foot of my paper on "Railroad Companies' Reports and Statistics," that my remarks as to expenses of management were not so clear as to avoid a misunderstanding. I said that the expenses of management "do not vary in proportion to the tons lifted or to the tons carried one mile; they consist, for the most part, of constant and arbitrary items; the managing expenses of two roads of the same size, one being a very large and the other a very small business, other things being equal, would differ very slightly." I do not yet see the incorrectness of my assumption. Expenses of management, as classified by me, must not be confounded with working expenses. Now, to render necessary an appreciable increase in the staff of the president's and superintendent's offices there must be a vast increase in traffic. The expenses of management will increase spasmodically, and not in direct proportion to and with the traffic. However, what I had most in mind at the time was the difference between the character of managements and the salaries paid to the same officer on different roads. Some managements the best I may say parenthetically—are liberal in the management departments; they pay good salaries, do not overtask their superior officers, allow an ample corps of assistants, and appreciate the fact that proper supervision saves its cost a hundred-fold by preventing waste. Unfortunately waste is an unseen leakage, whereas the salaries of supervising officials are visible in stubborn figures on the pay-rolls, and presidents imagine that when \$1,000 is struck off the pay-roll that much is saved to the company. The utter fallacy of the idea is perhaps appreciated only by those who have had practical experience of the two kinds of management. Again, we can see a road of even a thousand miles managed ably by a superintendent on a salary of \$10,000 a year, while another with several hundred miles less track and but half the business has a superintendent at \$10,000 and a general manager at \$25,000 a year. This difference is not caused by a difference in traffic. Expenses of management are influenced very much by net receipts, but net receipts do not bear a *direct* proportion to quantity of traffic or to working expenses. As the net receipts increase companies become more liberal, pay their officers better salaries, perhaps get better men, and allow them more assistance.

In whatever way I view it, the same conclusion appears to me correct, viz., that the managing expenses consist of "constant and arbitrary items," and that they depend in a *very slight measure* on the business done. Of course, the amount of business has an effect on them, but it is spasmodical and arbitrary.

H. E. S.

Inquiry into the Causes of Accidents.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your report of the late Master Car-Builders' Convention, Mr. Garey is represented as saying that "it was often impossible to tell by what what means an accident was brought about, and that it was always advisable to go right to work and clear the tracks, so that passengers could go on their travels with the least possible delay," and Mr. Childs followed suit, saying that "in the midst of a big smash-up, with half-a-dozen passengers lying about with their legs broken, there was no time to hunt up causes."

We must infer that the remarks of these gentlemen are in accordance with the custom of their respective roads, and that no systematic course is adopted for procuring inquiry on the spot into the causes of accidents. Unfortunately the Great Western and the New York Central are not alone in this error. As most roads the scene of accident is one of confusion and want of method; the spirit of destruction is unchained, and the original loss is not rarely supplemented with one that might have been avoided by care and patience. As Mr. Adams, in his reply to the above-quoted remarks, very truly said, the time spent in tracing an accident to its cause is well spent; information on that particular point will have a tendency to enable managers to prevent similar accidents in future. Besides, if what Mr. Garey says is true, that it is now often impossible to tell by what means an accident is brought about, that unfortunate fact makes it all the more necessary that effort should be made to discover the hidden cause of the disaster.

I do not wish to take up much of your valuable space with remarks on this subject, but I desire emphatically to protest against the official or semi-official declaration of such a reckless policy as that enunciated by Messrs. Childs and Garey.

To inquire into the causes of all accidents promptly, and to use all means whereby the causes may be discovered, is one of the high duties of a railroad superintendent, for the due performance of which he is responsible to the civil authority. It is not the province of the master car-builder to institute an inquiry, although he may frequently give valuable aid in the prosecution of it; but on every road there ought to be an officer whose special duty it should be to proceed to the scene of accident with full power to examine whomsoever he chooses and to command the aid of all employees of the company. Such person, after some experience would become familiar with the signs of causes and an adept in tracing them. A person without knowledge gained in the field, so to speak, and without considerable reasoning power and theoretical knowledge would be almost useless at such a time.

The manager of a road cannot be at every accident; an intelligent report from a person experienced in that particular line, describing the wreck, its causes, the methods adopted to clear the track, to protect exposed merchandise and the company's property, to aid sufferers, etc., with suggestions and animadversions, would prove of great value in almost every instance, and would be such a check on the persons employed at wrecks as to save yearly many times the salary of a well-paid inspector. At least, such has been my wrecking experience.

H. E. S.

The Validity of the Wisconsin Law.

The following is the text of the decision of the suit brought before the United States Circuit Court at Madison, Wis., by the Chicago & Northwestern Railway Company to enjoin the State officers from enforcing the Wisconsin Railroad Law. Judge Davis of the Supreme Court, and Circuit Judges Drummond and Hopkins were on the bench, and concurred in the decision:

We have not had time to prepare any opinion in the case, but as it was thought desirable that there should be a decision upon the motion for an injunction, I am instructed by the court to present the following as its conclusions upon the points made for a preliminary injunction:

1. On the assumption that the act of March 11, 1874, "relating to railroads, express and telegraph companies in the State of Wisconsin" is invalid, we think the Court has jurisdiction of the case. The bill is filed on behalf of citizens of Europe and of other States to enforce equitable rights, and to prevent action by the Railroad Commissioners which may result, as alleged in serious injury to those rights. It was not necessary to wait until the Commissioners had put the law in full operation, and its effect upon the railroad company had become complete, before the application against them was made to a court of equity. A very important function of that court is to prevent the wrong to the rights of property.

2. We are of opinion that the act of March 11, mentioned above, was not repealed by the act of March 12, 1874, the second section of which declares "all existing corporations shall have and possess all powers and privileges contained in their respective charters," and the act of March 12, 1874, the ninth section of which imposes a penalty for extortions' charges. There are apparent inconsistencies between these last named acts and that of the 11th of March; but it becomes a question of intent on the part of the Legislature. On the same day a joint resolution was passed (March 12) directing the Secretary of State not to publish the act of the 11th of March until the 28th of April. In this State no general law is in force until after publication. We may consider the joint resolution in order to determine whether the Legislature intended that the two acts passed on the same day should repeal the act of the 11th of March, and from that it is manifest such was not the intention of the Legislature.

3. The charters of the railroad corporations under the Constitution of Wisconsin "may be altered or repealed by the Legislature at any time after their passage." In legal effect, therefore, there was incorporated in all the numerous grants under which the Northwestern Railway Company now claims its rights of franchise and property in this State the foregoing condition contained in the Constitution. It became a part by operation of law of every contract or mortgage made by the company, or by any of its numerous predecessors. The share and bondholders took their stock or bonds subject to this paramount condition. If the corporation, by making a deed of trust on its property, could clothe its creditors with an absolute, unchangeable right, it would enable the corporation to abrogate one of the provisions of the fundamental law of the State.

4. The principle is not changed by authority from the Legislature of the State to a corporation to consolidate with a corporation of another State. The corporation of this State is still subject to the Constitution of Wisconsin, and there is no power anywhere to remove it beyond the reach of its authority.

5. As to the rates for the transit of persons and property exclusively within the limitations of this State, the Legislature had the right to alter the terms of the charter of the Northwestern Railway Company, and the fact that such alteration might affect the value of its property or franchises cannot touch the question of power in the Legislature. The repeal of its franchises would have well nigh destroyed the value of its tangible property; and while the latter, as such, could not be taken, still, its essential value for use on the railroad would be gone.

6. The fact that grants of land were made by Congress to the State cannot change the rights of the corporations or of the creditors. If the State has not performed the trust it must answer to the United States.

7. The act of March 11, 1874, while not interfering with the rates of freight on property transported entirely throughout the State, and from other States, includes within its terms property and persons transported on railroads from other States into Wisconsin, and from Wisconsin into other States. This act either establishes or authorizes the Railroad Commissioners to establish fixed rates of freight and fare on such persons and property. The case of "the State Freight Tax" reported in 15th Wallace, p. 232, decides that this last-described traffic constitutes "commerce between the several States," and that the regulation thereof belongs exclusively to Congress. It becomes, therefore, a very grave question whether it is competent for the State arbitrarily to fix certain rates for the transportation of persons and property of this inter-State commerce, as the right to lower rates implies also the right to raise them. There may be serious doubts whether this can be done. This point was not fully argued by the counsel, and scarcely at all by the counsel of the defendants; and, under the circumstances, we do not at present feel warranted, on this ground alone, to order the issue of an injunction. If desired by the plaintiffs, it may be further considered at a future time, either on demurrer to the bill or in such other form as may fairly present the question for our consideration.

The motion for an injunction is overruled. In view of the decision just rendered, we trust it will not be considered out of the line of our duty to make a suggestion concerning this litigation to the counsel for the defence. It is manifest that the questions involved are grave ones, and that the courts of last resort will ultimately have to pass upon them. It is equally manifest that a speedy decision, in which all parties are vitally interested, cannot be obtained unless there is harmony of action on the part of both the complainants and defendants. In the mean time, and while this litigation is in progress, would it not be better for the defendants, as far as lies in their power, to have prosecutions for penalties suspended? These prosecutions are not required to settle rights. They are attended with great expense, and if enforced while an effort is making, in good faith, to test the validity of this legislation, must cause serious irritation, and cannot be, as it seems to us, productive of any good results.



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S. WRIGHT DUNNING AND M. N. FORNEY.

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Editorial Announcements.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR, RAILROAD GAZETTE.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE WISCONSIN DECISION.

The decision of the United States Circuit Court at Madison, Wis., on the application for an injunction to restrain the State officers from the enforcement of the Wisconsin railroad law has deservedly attracted a great deal of attention, and has occasioned a distrust of the value of Wisconsin railroad properties which is perhaps not wholly justified by the terms of the decision. Indeed, the distrust has extended to railroad properties in other Western States where the terms of the charters are fundamentally different from those of the Wisconsin companies. In the latter States, and in very few others in the country, we believe, the State constitution reserves to the State the right to alter or amend all charters at the pleasure of the Legislature, and it is on this provision of the constitution that the decision of Judges Davis, Drummond and Hopkins is based. The Legislature may alter the terms of the contract which it has made with the companies in this State, or rather by the terms of the contracts (of which this constitutional provision virtually forms one) the Legislature was to have authority to change them.

The companies hold that while this right of the Legislature to amend the charters unquestionably exists, it does not extend so far as to destroy the means by which the corporations exist. They claim, and in the case of the two whose routes are made lowest by the law the claim is doubtless true, that the law will not permit the companies to earn the interest on their debts secured by mortgage, in which case the corporation will be deprived of its property in order to satisfy the bondholders.

Now, so far as we know, there was no attempt made by the Chicago & Northwestern Company to prove before the Court what would be the effect on net earnings of the rates established by the law, and the Court, while deciding that the Legislature has the authority "to alter the terms of the charter" as to the rates for the transit of persons and property within the limits of the State of Wisconsin, did not decide, at least not explicitly, that this authority extends so far as to justify it in making rates so low that the companies cannot earn a reasonable interest on the capital invested, or the interest on their funded debts, or even their working expenses.

The Court declined to decide whether an injunction should be issued to prevent the application of the State law to rates on traffic between Wisconsin and other States

without further argument, but intimated its inclination to believe that such an application of the law would be in conflict with the constitution of the United States. It is recommended, however, that the counsel in the case make such an agreement as to do away with the necessity of further argument before the Circuit Court and make it possible to have the case tried and finally decided by the Supreme Court next October, and recommended that meanwhile prosecutions under the law be suspended.

Of course if the validity of the law shall be sustained in the court of final resort, there can be no doubt that people have made a great mistake in investing money in Wisconsin railroads, for it will be an affirmation that the whole people of Wisconsin, all of whom are customers of the railroads of that State while only an insignificant number of them are railroad proprietors, have the sole right to fix the prices which they shall pay for transportation within the State. But as the investments have been made and the railroads built, we will do best to endeavor to trace the probable effect of the execution of the law and the principle of the law on the existing railroads and the business of transportation.

It has been urged that the exemption of inter-State transportation from the application of the law will very greatly limit its effect on the earnings of the railroads. This belief, we think, arises from a misapprehension both of the existing proportion of through traffic to and from Wisconsin and of the routes by which it may move. The chief exports of Wisconsin are wheat and lumber. Most of the wheat at this day is not carried across the State line by rail, and most of the lumber is not carried by rail at all to markets outside of the State. The grain goes chiefly, and a very large part of the lumber also, either to Milwaukee or Chicago. Now if the law is decided not to apply to traffic to and from Chicago, there will be indeed no legal obstacle to making the rate on Chicago business high enough to pay a profit on the cost, or even enough to make up in part the loss on Wisconsin traffic. But what will be the result of such a rate? Simply the diversion of all traffic possible from the dear Chicago to the cheap Milwaukee route. And the proportion of traffic which can be so diverted is much larger than many may think. It is true that the Chicago & Northwestern has no route to Milwaukee from the largest part of its system, but a very large part of its patrons can reach one of the lines of the Milwaukee & St. Paul and will do so if they can save much by it. Most of the rail freights to and from the East now doubtless pass around Lake Michigan by way of Chicago, and if they were confined to that route would be subject to "inter-State" rates on the Chicago & Northwestern and the Milwaukee & St. Paul; but they are not confined to that route. Just as soon as it costs very much more to ship to Chicago than to Milwaukee, the through freights will go by way of the latter place and submit to the short lake carriage across Lake Michigan to Grand Haven and the Detroit & Milwaukee Railroad, and thus avoid entirely any use of the Milwaukee & St. Paul and the Chicago & Northwestern outside of the State of Wisconsin and the domain of the Potter law.

Moreover, if the principle of this law is held to be valid, there will be nothing to prevent further reductions of rates, and such reductions might be and probably would be made in such a way as to neutralize as far as possible a higher rate on inter-state than on purely Wisconsin traffic. The State would say, substantially, "If you attempt to make a million more on your traffic to and from Chicago, we will see that you earn a million less on your Wisconsin traffic."

Assuming that the law is valid, that it will be enforced, and that it will have the effect asserted by the railroad companies of reducing their gross income by one-fourth and their net income by about five-sixths, what will be the effect? As the Wisconsin railroads have earned dividends only in exceptional cases of late years, the net earnings being chiefly absorbed in interest payments on the funded debt, it is evident that one-sixth of such net earnings will not pay this interest, the companies must become bankrupt and the roads will become the property of the present bondholders, whose income will be limited by the law to something like one or two per cent. on the face of their bonds—no longer bonds but equivalent to stock. This is not the end of the property however. The railroads of Wisconsin will no longer be subject to bankruptcy unless their earnings fall below their working expenses, and the then proprietors will be satisfied probably with interest on about \$25,000 or \$30,000 per mile, that representing their investment. The people of Wisconsin will have secured an extremely small capital account for their railroad system, on which they will pay something like one-fifth of the ruling rate of interest in their State, and, aside from the honesty of the transaction, they may seem to have profited by the law which virtually deprived the stockholders of their property and gave it to the State. To be sure they will have put an end to the construction of new railroads, but for a considerable period that will be a calamity to very few people in Wisconsin. The settled parts of the State

are already well provided, in some parts too well provided, with railroads, and the present citizens have little interest in the further development of the unsettled parts. They can very well do without new railroads if they can have the use of the old ones for nothing or next to nothing, and the exceptionally low rates on these would tend to attract manufacturers and population, and to increase the value of real estate accessible to these roads. So far the law would seem to have profited the State and done it very little damage. But we have not yet reached the end. While the settled part of the State has lines enough for a considerable time to come, and they are now probably quite equal to their traffic, and can carry it much cheaper than more railroads on the same ground, just as soon as the traffic grows, as we have seen that unduly low rates will tend to increase it in course of time, the roads will be choked by it for lack of additional rolling stock, sidings, second tracks, station yards and buildings, etc. That is, the Wisconsin railroads, like all others in a growing country, will need expenditures of new capital in order to accommodate their traffic, while this want will probably be greater or come sooner than in most other growing countries because of the non-construction of new railroads and the maintenance by law of rates below cost.

So after a few years of the Wisconsin law we would find the roads choked with traffic and a pressing necessity for the expenditure on them of large amounts of capital, without which the progress of the State would be arrested. The proprietors of the railroads at the time (its late creditors) we would see limited to an income of perhaps two per cent. on their investment. Of course neither they nor any other capitalists would make any more such unprofitable investments. If, the need becoming pressing, the State should pass a law permitting rates high enough to return a reasonable profit on the new or the whole investment, there would remain the constitutional provision under which at any time the rates might be reduced to any extent, with the precedent, vivid in every investor's memory, of a reduction which had robbed the old railroad stockholders of all their property and taken two-thirds of the value from that of the bondholders. Would any sane man lend or invest his money under such circumstances? Certainly not. There would remain but one way for the State, maintaining the constitution so interpreted, to escape from its difficulties and provide the additional facilities for transportation necessary to its prosperity; this would be to appraise, condemn, pay for and take possession of all the railroads under its right of eminent domain and improve them on its own account and by its own capital, raised by loans on taxation, working them for the public good by its own agents. This would be and is a perfectly legitimate and proper mode of procedure, and, we believe, the only practicable one in the long run which is compatible with the authority of the State to fix absolutely the rates for transportation in communities like those of the Northwest. The power of a Legislature to make the rates for transportation unreasonably low if it pleases is safe only in communities where a large proportion of the citizens are owners of railroad property. Such an attempt in England, where Parliament has the power, as is said, to do anything imaginable, would bring out the active opposition of a large number of influential people whose income and almost their daily bread would depend upon the defeat of the measure. They might hold comparatively few votes, but they would wield an immense influence, would demonstrate elaborately the injustice threatened and interest in their behalf that great mass of people not directly interested who are not willing to have injustice done, especially to their friends. In Wisconsin and other Western States there are very few railroad proprietors. The owners of the stocks and bonds of the railroads of these States live chiefly in New York, Massachusetts, England, Holland and Germany. Few voters know any men who will suffer by an unjust law, or will be able or take the trouble to point out its injustice; and they distrust those who are simply agents of the proprietors.

While, therefore, the natural tendency of a law like that of Wisconsin, in such a community at least, would seem to be to force the State to become the proprietor of its railroads eventually, this State ownership would also seem to be the only condition compatible with authority in the Legislature to determine tariffs absolutely. State ownership and management, though probably not economical, and scarcely capable of success except where the administrative officers have the training and experience hardly to be gained without something like permanency of position, would still have some advantages not lightly to be passed over, not the least of which would accrue to the proprietors of railroads. There are some lessons which the community will hardly learn until it has itself undertaken to conduct the business of transportation.

Adjusting Tariffs to Expenses.

Under the head of "Increase of Freight Tariffs," a valued correspondent intimates that we may be reducing

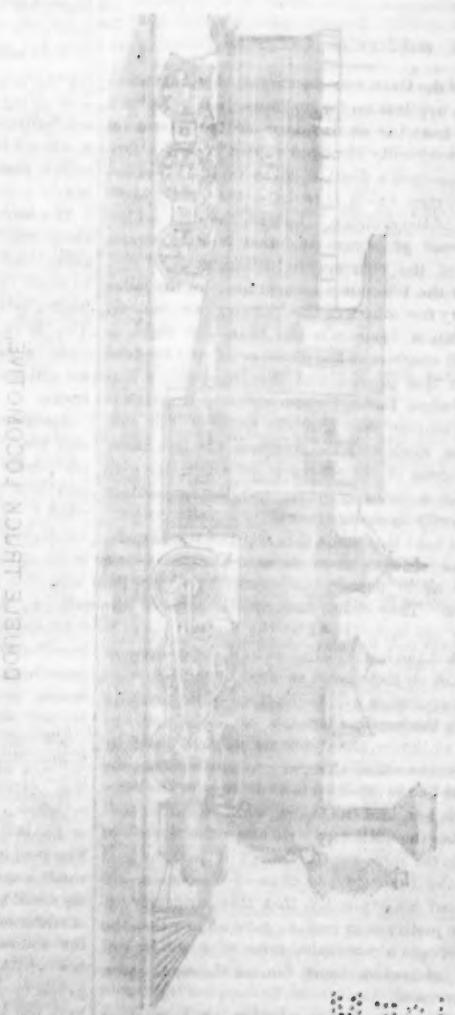
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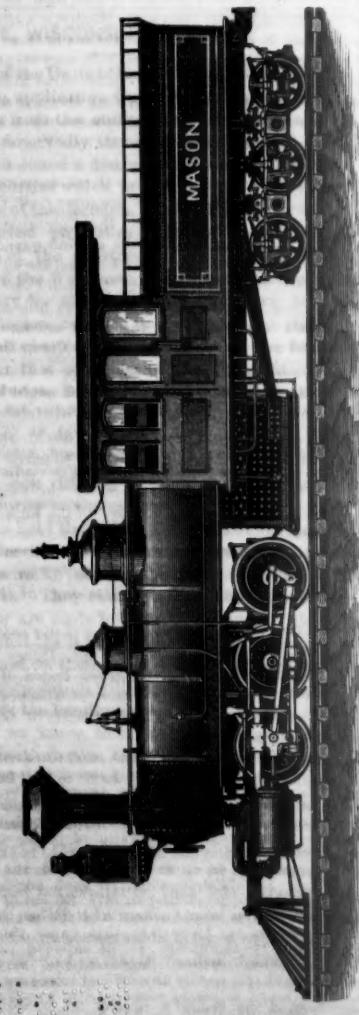
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WISCONSIN

CHECKED ON THE RECORDING

CATECHISM OF THE LOCOMOTIVE.

PLATE 5.

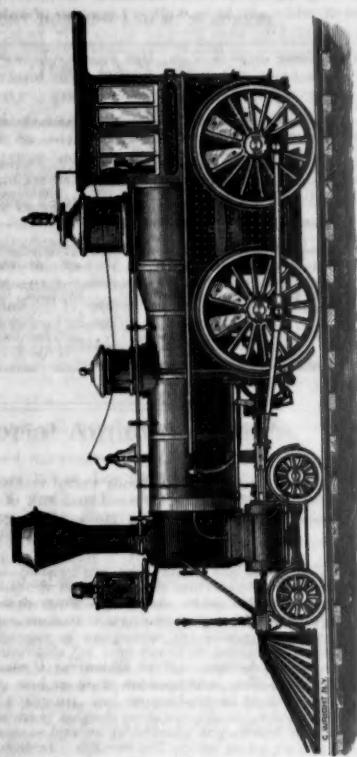


DOUBLE TRUCK LOCOMOTIVE,

BY THE MASON MACHINE WORKS, TAUNTON, MASS.

Scale, $\frac{1}{8}$ in.—1 ft.

PLATE 6.

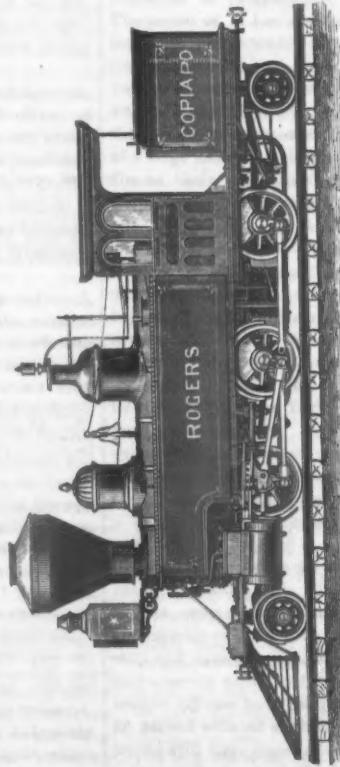


EIGHT-WHEELED "AMERICAN" LOCOMOTIVE,

BY THE DANFORTH LOCOMOTIVE AND MACHINE CO., PATERSON, N. J.

Scale, $\frac{1}{8}$ in.—1 ft.

PLATE 7.

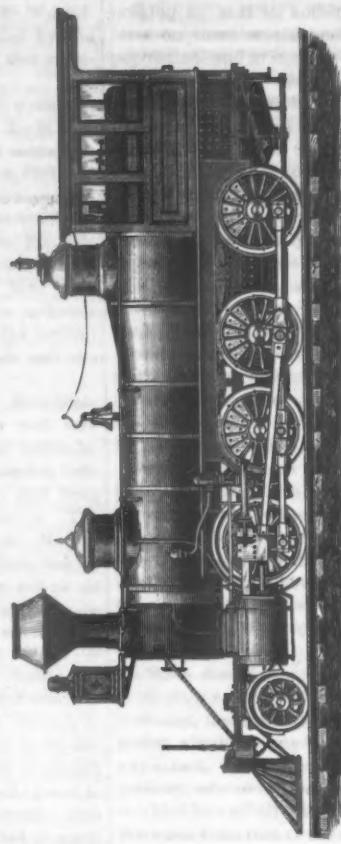


TANK LOCOMOTIVE,

BY THE ROGERS LOCOMOTIVE AND MACHINE WORKS, PATERSON, N. J.

Scale, $\frac{1}{8}$ in.—1 ft.

PLATE 8.



"CONSOLIDATION" LOCOMOTIVE,

BY THE DANFORTH LOCOMOTIVE AND MACHINE CO., PATERSON, N. J.

Scale, $\frac{1}{8}$ in.—1 ft.

freights too fast in this country, and that it will be extremely difficult to raise them if they should be found unremunerative. There is not generally a great difficulty in making the price for transportation keep pace with the cost, if the increase in cost occurs (as almost universally it does) in a time of generally rising prices, and while the community is enjoying the prosperity common at such a time. We had experience of this in this country during the war, when prices of transportation, as of everything else, were largely raised without any general complaint. It is when business is dull and expenses, necessary or not, are burdensome, that people complain of high prices. The difficulty is made greater in Germany than here, because the German railroads have not been able to adjust their rates to their increasing expenses at the time when the expenses were growing, and when manufacturers and dealers were remarkably prosperous. Having first to get the permission of the Government, and to wait until the increased expenses had had their effect for a considerable time and demonstrated incontestably the insufficiency of the income from transportation, they are able to raise their tariffs to suit the era of high prices only after the prosperous times have passed, and when the increase in rates will be unusually burdensome on industry. It is evident that if the roads had been free to adjust their own rates to their circumstances, they would have been raised gradually during the late period of extraordinary prosperity, and that then such a proceeding would have caused little injury and provoked little opposition; while, having enjoyed prosperity in common with the rest of the community during that period, the companies would be able now to reduce their rates in accordance with the lower prices of coal and iron; and though that reduction could not probably have reached the figures of past years, it might still have given tariffs lower than those which the new law will authorize. In fact, German industries have, it seems, had part of their legitimate expenses paid by the railroad companies, and that during a season of extraordinary prosperity. Now, when they are no longer prosperous, they of course feel very strongly rates which, only fair to the carrier, are considerably higher than heretofore.

With regard to Belgium, it is not likely that rates will be increased. The State works many of the most important lines, and through them controls largely the tariffs throughout the Kingdom, which are, moreover, limited by the laws under which they were constructed. In the depressed condition of industry, the manufacturers are likely to exercise such an influence against increasing rates that the Government will prefer to meet from the Treasury any deficit caused by inadequate earnings. Indeed, it seems probable that there was substantially a deficit in 1873—the net earnings not covering the interest on the cost of the property.

The Belgian rates have been considered successful, we believe, at least until the great rise of coal, iron and wages of the past few years, though it is true that a tariff preceding the one now in force was given up as too low. That, however, has little significance, except as showing that in experiments to find the lowest tariff to produce an adequate income an error was once made on the side of too low rates, as had been previously made on the other side. Indeed, the question could hardly have been settled without trying such a rate; at least, it would be impossible to satisfy the community using the railroads that the limit of cheapness has been reached until one has been tried which is too cheap—which does not yield a sufficient income. Until then it will be said that if rates were lower the railroads would earn more. Having tried a rate which did not stimulate traffic enough to make up for the reduction, the Belgians could not reasonably oppose a higher one, especially as the deficit from the inadequate rates had to be met from their own pockets by taxation.

The principle proposed by the Massachusetts Commissioners is, we believe, perfectly correct. Of course it requires an intimate knowledge of the special circumstances to apply it in each case; and our more intelligent managements apply it quite generally. But it requires the very opposite of an equal tariff; a strongly discriminating tariff is the very substance of it. A company may well carry coal entirely without profit if so it will secure the establishment of industries on its line which will give many car-loads daily of profitable traffic, and cause a considerable increased movement of passengers. To be sure a blundering management might make rates such as not to increase their profitable traffic, but simply to transfer industries from one part of their road to another, or to transfer labor and capital from one industry to another; but a blundering management may produce bad results with almost any policy.

The increase in German tariffs is not on account of any original inadequacy, but solely because of the enormously increased price of labor and materials, an increase which, except in the case of iron, has hardly extended to this country at all, and of which most Americans have no adequate idea. In this country the growth of traffic is so rapid that it usually more than balances any fortuitous rise in prices, and so that is an exceptional year when the average rate does not fall.

The Rock Island Railroad and the Iowa Law.

Mr. Hugh Riddle, the Vice-President and General Superintendent of the Chicago, Rock Island & Pacific Railroad, in announcing to the Governor of Iowa the policy of the company with regard to the law limiting charges which went into effect on the 1st inst., discusses the law and its application to the Iowa properties of the Rock Island Company, giving by the way considerable information concerning that part of the company's lines not heretofore made public.

The law fixes charges for roads with gross earnings of \$4,000 per mile by a certain schedule which gives rates from 30 to 40 per cent. lower than those heretofore charged by this company, whose average gross earnings from its Iowa lines for the year 1873 were \$5,571.55 per mile.

Mr. Riddle's letter shows that the passenger traffic of the company in Iowa (except that of the Chicago & Southwestern) has increased from 22,701,661 passenger miles for the year ending with March, 1867, to 49,186,817 miles for the year ending with March, 1874, while the average amount received per passenger per mile has fallen from 4.357 cents in the first year to 3.394 in the last year, the decrease in the average rate having been about 23 per cent. in the seven years. The tonnage mileage during the same period increased from 79,565,902 to 249,523,401, while the rate per ton per mile fell from 3.05 to 2.07 cents, or 33 per cent., the improvement in the manner of doing the work, by adopting costly appliances for safety, comfort, etc., having been meanwhile very great.

The company works in the State of Iowa 574.58 miles of railroad. The main line, with the branch from Wilton through Washington to Sigourney, 396.77 miles in all, earned gross during the last fiscal year \$2,833,614, or \$7.137 per mile, the 48½ miles of the Indiana & Winterset Branch \$1,686 per mile, the 129.58 miles of the Chicago and Southwestern \$2,206 per mile, the total being \$3,201,302, or, as noted above, \$5,571.55 per mile. The net earnings, however, amounted to but \$787,839, or \$1,371.26 per mile of road, the Main Line, with the Sigourney Branch, returning about \$1,990 per mile, the Indiana & Winterset \$416, while the Chicago & Southwestern netted a loss of about \$150 per mile.

This inequality of earnings is used to show the injustice of requiring equal rates on all lines worked by a single company. Thus on the Chicago & Southwestern, which does not earn its expenses, the lowest rates known in the State must be charged simply because it is worked by a company whose average earnings per mile place it among railroads of the highest class.

The schedule adopted by the Iowa law to apply to the railroads of the class to which the Rock Island belongs is one 10 per cent. less than the lowest adopted by the Illinois Railroad Commission, which applies to this road in that State. Now Mr. Riddle says that, owing to less favorable grades and curves, it costs more to haul an equal weight in Iowa than in Illinois, that the cost of fuel is about 8 per cent. greater, while other expenses, owing to the much lighter traffic, are much greater.

It is believed that a reduction of the rates in accordance with the requirements of the law on all the Iowa traffic of the road would result in an average decrease of 35 per cent. in the gross earnings, which would have caused during the last fiscal year a net loss of \$332,507 instead of the actual net profit of \$787,898.

Under these circumstances, the company sees no way to provide for the working expenses and a reasonable profit upon the investment, under the law, but by discriminating between the local traffic, wholly within the State, to which the rates apply, and the inter-State traffic, passing for part of the distance over the Illinois line of the company, over which the State Legislature has no color of authority. This the company, while denying the justice and the constitutionality of the law, has determined to do. It does not believe that the schedule made in accordance with this determination will be either satisfactory or successful; but it seems to be the only method for the company to obey the law without committing suicide. It is hoped, however, that practical good will result from subjecting the act to the test of actual experiment. It may contribute something toward either confirming or dispelling new theories in regard to transportation, and bringing about a better understanding of the principles which should govern the relations existing between the owners of railroad property and the public. If actual experiment shall demonstrate that a continued observance of these schedules will not result in total or practical confiscation, it may not be necessary to raise any question as to the validity of the act. If the results of a thorough and satisfactory experiment show that such observance must involve a permanent surrender of the revenues to which the company is entitled from the operation of its lines, a different policy will be adopted, with a view to securing such revenue, and any attempt to enforce the act, as a valid law, will be resisted in the proper tribunals."

Plates 5, 6, 7 and 8.

We publish with this number another series of engravings of locomotives, which will be fully discussed in a future chapter of the Catechism. Two of the engravings, the one by the Mason Machine Works, and the other by Rogers Locomotive Works, will attract attention on account of their novelty. The first is built on the double-track principle, and it is estimated by Mr. Mason that it will do twice the work done by an ordinary thirty-ton engine. The cylinders are 16 x 24 in., and the driving wheels 3½ feet in diameter. The weight on the driving-wheels is 60,000 lbs., and the tank has a capacity of 2,500 gallons. Mr. Mason has now built, we believe, ten engines of different sizes and gauges on this plan, and the fact that so experienced and skilful an engineer as he is known to be should risk his reputation and money in the success of this plan shows that he at least has great confidence in its merits. Although no complete tests of the working of any of these engines has yet been made, we have received very

favorable reports of the operation of some of them. The valve-gear, it will be observed, is of the Walschaert pattern, which is much used in Europe, but is thus far but little known in this country.

The tank engine by the Rogers Works has also much that is novel in its construction. It was built for a South American railroad of 4 ft. 8½ in. gauge. It has 15 x 20 in. cylinders, driving wheels 40 in. in diameter. The fire-box is 48 in. long, 34 in. wide and 56 in. high. Diameter of waist of boiler 46 in. at the middle, with 132 2-in. tubes, 8 ft. 10 in. long. The total wheel-base is 24 ft. 7 in.; the distance between the centers of the front and back drivers is 12 ft. The total weight, with two tons of coal and tanks, whose capacity is 2,000 gallons, full of water, is 83,861 pounds. The weight on the leading wheels is 9,172 pounds, on front drivers 21,110, on middle driving wheels 23,111, on back driving-wheels 23,111, and on trailing wheels 8,357 pounds. The leading and trailing wheels are arranged with lateral motion on the Bissell system with the improvements of Mr. W. S. Hudson.

The Consolidation engine, by the Danforth Company, is of the ordinary pattern built at that establishment. We regret that we have not the dimensions of this machine, but will give them hereafter in the chapter of the Catechism in which the different kinds of locomotives will be discussed.

The "American" engine, by the Hinkley Locomotive Works, is of their ordinary pattern, and their usual tasteful design and superior workmanship.

Record of New Railroad Construction.

This number of the RAILROAD GAZETTE has information of the laying of track on new railroads as follows:

Boston, Concord & Montreal.—The Twin Mountain Branch has been extended from Twin Mountain eastward 6 miles to Fabyan House (within six miles of the lower terminus of the Mount Washington Railroad). *Buffalo & Jamestown.*—Extended from Lawton's southward 3 miles to Gowanda, N. Y. *Savannah & Memphis.*—Extended from Salisbury northwest 10 miles to Alexander City, Ala. *Palisade & Eureka.*—Extended southward 10 miles to a point 20 miles south of Palisade, Nev. *North Pacific Coast.*—Extended from Sausalito, Cal. northward 5 miles. It is of 3-foot gauge.

This is a total of 34 miles of new railroad, making 637 miles completed in the United States in 1874.

MEXICO is the last field which our railroad agents have entered in search of custom. Already they had canvassed Japan, China, Australia, and India, and now we see in a Mexican newspaper an advertisement announcing that the "Jackson Railroad" (the new New Orleans, Jackson & Chicago) as "el camino mas corto, mas violento y mas barato" from the City of Mexico to Chicago and New York. This advertisement gives the time, estimating the steamer journey between Vera Cruz and New Orleans at three days, at 112 hours to Chicago, 132 hours to Washington, and 142 to New York by this route. Thus it seems to take less time to go to the City of Mexico than to San Francisco, even from Northern cities, and with steamers from Galveston the above time and the sea journey will be considerably reduced. Mexico is a country of remarkable attractions which will doubtless draw a good many tourists when it and the comparatively easy means of reaching it become better known. Our intercourse hitherto has been so limited that most of us forget that there is on our southwestern border a country with many large cities and a population equal to that of New York and all New England.

THE CONNECTICUT RAILROAD COMMISSIONERS will have some active exercise to vary the monotony of their office work should the bill to reorganize the Commission, which is now pending, become a law. While the bill was under consideration in the lower house of the Legislature an amendment was offered and adopted providing that some one of the Commissioners should pass on foot over every mile of railroad in the State once each year. As the total mileage of the State is about 900 miles, and there are three Commissioners, each one will have about 300 miles of road to walk over. An average of six miles a day would enable him to accomplish this in 50 days, leaving him ample time for his other duties. So it would be no very arduous task after all, but we fancy a grave and presumably middle-aged Commissioner would hardly care to make his way on foot over the lofty viaducts on the New Haven, Middletown & Willimantic or the long trestle bridges on the Shore Line, to say nothing of the high bridge at Windsor Locks.

On Simplicity as the Essential Element of Safety and Efficiency in the Working of Railways.

The following is an abstract of a paper read before the Society of Arts and prepared by Capt. Henry Whatley Tyler, Chief Inspector of Railways, British Board of Trade, who is just now in this country on leave of absence, engaged in an inspection of the condition and capacity of the Erie Railway for its English shareholders:

The various classes of collision, and the accidents at facing-points, may together be roughly stated to comprise from two-thirds to three-fourths of the casualties to railway trains which are considered of sufficient importance to require investigation on the part of the Board of Trade; and questions as to the arrangement and working of points and signals, and as to preserving intervals of time or space between trains, and their accessories, enter more or less into the causes of such casualties. In 1872 there were 179 such accidents out of 239 investigated train accidents; in 1871, 105 out of 159; in 1870, 97 out of 122; and it would seem to be the preferable and more useful course to put forward in this paper the principles involved, the requirements to be satisfied, and the direction in which further improvements may be effected. There is, perhaps, hardly any subject in regard to which there has been more misunderstanding, or greater confusion of ideas, than simplicity in railway working. The Latin words *simplicitas* and *simplex* convey, no doubt, the idea of singleness—of one thing; and a simple machine is in the same sense a machine of few parts, while a complicated machine is a ma-

chine of many parts. But simplicity of construction and simplicity in working are in many cases distinct and different from one another; and, further, complication in construction is frequently necessary to obtain simplicity in working. This is equally true of a machine, of a railway, or of sentence. Simplicity in working, as desirable, being the thesis, confusion in working, as undesirable, is the opposite idea presented for consideration in the present paper.

The first important branch of railway working to which reference may be made is that of points and signals. When trains were few, and there was little risk of their interfering with one another; when they had the same regular stoppages, and the speed was not great; when junctions, stations and sidings were less frequent; then fixed signals were comparatively unimportant, the switches did not require to be so often moved, and facing or meeting switches were not the cause of so much risk. By degrees stations and junctions became more complicated, and the points and signals increased in number, and were at greater distances from one another. The signalmen sometimes had to leave their signal-lovers for the purpose of working points more or less distant from them, and occasionally at the opposite sides of lines of rails, which might be occupied by trains; and sometimes the points were worked by one man and the signals by another. But the mistakes, misunderstandings and accidents which resulted from such conditions—under which a signalman either himself omitted to work his points and signals in harmony, or signalled forward a train for one direction while a pointman's at the points for another direction, led naturally to the concentration of the signal and point levers in or around the signal cabin; and, to afford a better view to the signalmen over passing trains, wagons in sidings, or other obstructions, the cabin were raised to a greater or less height above the ground, and placed in convenient situations, according to local circumstances. But even then, when the control was more conveniently placed in the hands of one man, there was still, as the levers in or near a cabin became more numerous, a liability to mistake from the signalmen pulling over a wrong lever; or the levers were fastened over by blocks of wood which the signalman forgot to remove; and, to prevent such mistakes, and serious accidents resulting from them, it became further necessary to interlock the levers with one another. This important improvement was suggested, as being probably feasible, by Colonel Yolland, in a report dated January, 1856. In 1860 many further improvements had been made by different persons, and the inspecting officers of the Board of Trade began to insist on the use of locking apparatus at the junctions of new branches with existing lines. The principle was also carried out in that year at the signal cabin at the entrance to the Victoria Station. By the application of locking and other apparatus it is possible to prevent nearly all of these accidents from occurring, in the ordinary way of working, in consequence of any mistake of the signalmen. Conflict between points and signals, and conflict between points and signals, may alike be avoided; and a good combination of locking-bar and bolt may be made to insure that the facing-points are completely over before the proper signal is lowered, and may also prevent them from being moved during the passage of a train. There is, however, no means of providing against accidents from engine-drivers neglecting to obey signals on the branch up-line, either when a main-line down train has entered the facing-points or when a main-line up-train is approaching the junction from the opposite direction. In more complicated situations, when there are cross-over-roads between the main lines or branch lines, or both, and through-crossings, and sidings connected at different points with the passenger lines, or where passenger lines are more numerous, and are connected at various points with goods lines and with one another, then the locking system becomes more complicated. But it is then also of still greater utility in securing the traffic from accidents, which become otherwise more likely to occur in consequence of mistakes on the part of signalmen. The control of the signalman is rendered more perfect by the addition of blind-sidings, so as to provide safety-points—where such are not in the laying out of the yard or lines otherwise available—to goods lines or sidings near their junctions with the passenger lines. These safety-points serve alike to prevent wagons from being blown out, or inadvertently run out or pushed out, and to prevent an engine-driver from proceeding against signals and endangering the traffic on the passenger lines; but the levers of the safety-points require to be worked from the cabins, and to be properly interlocked with the other levers in the cabins. Other devices or provisions for enabling the signalmen better to perform their duties may be mentioned, such as—the system of slotting, as it has come to be termed, the connections of a signal, so that the arm of it may be raised to "danger" by a signalman in either of two neighboring cabins, but can only be lowered to "clear" by the joint action of the signalmen in both the cabins; the application of repeaters of various descriptions, either to inform the signalmen of the working of any signals which may be out of their sight, or to afford a more distinct indication, where such is required, to the engine drivers; the means of information by telegraph as to when trains may be expected; clocks to furnish the correct time; and register books in which to record the telegraph signalling and passing of trains, so as to secure the regular performance of the duties, and to provide a check on the working of the signalman in any one cabin by the working of the signalmen in cabins on either side of it. Under such arrangements, engines and trains may be turned in and out and across one another with marvelous rapidity and facility, and in a way that would be impossible without the protection that they afford. The more numerous and complicated the lines, the sidings and the crossings to be worked, the more indispensable does such apparatus become; and it is then frequently a means of considerable economy in the number of men employed, as well as a means of avoiding much sacrifice of life and limb to running pointsmen, yardmen and shunters, whose services are to a great extent dispensed with. The comparative simplicity of the system, too, will be best understood by an examination, and by watching the working of any complicated stations or junctions at which it has not yet been applied; and it may to some extent be conceived by remembering what the confusion and complication in working would be if these levers were of all sorts, sizes and shapes, scattered about in various situations, worked by different men, and independently of one another.

The next branch of the subject is that which refers to the preservation of intervals between the trains. It is obvious that as long as any interval, whether of time or space, is actually preserved between any two trains, they cannot come into collision with one another. Collisions are liable to occur between trains following each other on the same line of rails; or, within fixed signals, at stations, sidings, junctions, &c. The greatest number of collisions occur at stations or sidings, and within fixed signals. In 1872 there were ninety-one cases of collisions at stations or sidings, thirty-two cases at junctions, twenty-two cases from trains following one another, five from trains meeting in opposite directions, and thirty-four from passenger trains being wrongly turned into sidings or otherwise through facing points—out of a total of 238 train accidents investigated by the Board of Trade. As soon as the trains were run with sufficient frequency to endanger one another, it became obviously necessary to establish some system of preserving intervals between them; and the practice obtained of allowing a certain number of minutes to elapse, not only between their times of starting, but also between the times at which they should pass intermediate

stations, and any junctions, or level-crossings, in charge of gate-keepers, or other points at which servants of the companies were stationed; and the platelayers were also on many lines expected to warn any train which appeared to be following too closely upon a preceding train. In tunnels it was further found necessary to prevent one train from entering at one end until the preceding train had passed out at the other end, and this was the commencement of what is called the block system, by means of which an interval of space was secured in place of an interval of time between the trains. The time interval which came to be generally adopted were five minutes of danger and five minutes of caution, that is to say, the trains were to be kept five minutes apart from one another in their running, and were to be cautioned if they were not ten minutes apart. But in the case of goods or slow trains preceding fast non-stopping trains, still greater intervals were required; and sometimes periods of fifteen or twenty, or more minutes became, as the differences in speed increased, insufficient safely to admit of heavy goods trains being started in front of express passenger trains. It was recognized at an early period that the simplest and best mode of avoiding collisions at stations and sidings was by keeping the main lines clear for passenger trains; and accordingly it was provided in the regulations that the main lines should not be interfered with, in the way of obstructions or shunting, within ten minutes of a passenger train being due, and, sometimes, within fifteen minutes of an express train being due. The proposal to divide the line into telegraphic sections, and thus to preserve space intervals between trains, was made by Mr. Cooke as far back as 1842, and was first practised, it is believed, on a portion of what is now the Great Eastern Railway, in 1844; and, subsequently, a train telegraph system was established on portions of the London & Northwestern Railway. This latter, however, was not a block system, or a space system, but a time system worked with the aid of telegraph instruments; and it is now known as the permissive system. Under this system the line between London and Rugby was divided into sections averaging rather more than two miles in length, and the signalmen were required to telegraph the trains to one another; to turn their signals to danger on the passage of every train; keep them at danger for three minutes, or more in certain special cases; to exhibit caution signals after the expiration of the three minutes; and only to give clear signals again after receiving "line clear" from the next cabin in advance. In the case of tunnels no second train was allowed to enter until the preceding train had been signalled as "out," and a space system was thus introduced; but on other sections two or more trains were allowed to be traveling at the same time; and even if a second train reached a cabin before a preceding train had passed the next cabin, and within the three minutes prescribed for the exhibition of the danger-signal, the engine-driver was, after his train had been brought to a stand, to be warned of a train in advance and to be allowed to proceed. This system is worked by needful instruments, the needles being pegged over to "line blocked" or "line clear," as the case may be; and the vertical position of the needle is taken to indicate either that the telegraph is out of order or that the line is obstructed. On certain telegraph posts special loops of the telegraph wires are provided, to be broken by the guards or brakemen of trains in the event of sudden obstructions; and in long tunnels the loops are inclosed in boxes at intervals of about 100 yards. By breaking these loops, the guards or brakemen are enabled to inform the signalman at either end of a section, of an up-line or a down-line, or a third line, or two or three lines, being suddenly obstructed by an accident to a train.

As regards the block system, there are many descriptions of means of instruments for working it, and various rules and regulations applicable to it on different lines of railway. The main principle involved is, simply, by the division of a line into block sections, and by allowing no engine or train to enter a block section until the previous engine has quitted it, to preserve an absolute interval of space between engines and trains. This may be done mechanically or electrically. Any means of communication with which the signalmen may be provided will enable them to inform one another of the approach of a train, of its entrance into a block section at one end, and of its exit from that block section at the other end. The raising or lowering of signal arms inside or outside the cabins, the beats on mechanical gongs or bells, the beats on electric gongs or bells, or the working of different descriptions of telegraph needles or instruments, may any of them be employed to afford indications of this description. But in many cases it is considered necessary to give further information, such as the description of the train, whether a through or stopping passenger train, or a goods or mineral train, or a ballast train, or a light engine; and to provide, besides the signals for line clear or line blocked, separate indications also for an acknowledgment signal, for an attention signal, for an obstruction signal, for an error signal, for a testing signal, for notice of shunting going on at a station, for a train to be shunted out of the way to allow another to pass it, or for a train to be stopped and examined in the event of something suspicious or wrong having been observed in it. Then, again, on some lines distinction is made between passenger trains, express goods or cattle trains, through goods or mineral trains, stopping goods mineral or ballast trains, and as to whether these are approaching or whether they have entered the section. These and other indications are differently made on different lines. In some cases the block instruments are used for them; in some cases they are made exclusively on electric bells; in some cases single-needle speaking instruments are employed. On certain lines the block system is used for the protection of junctions; no two trains which could come into collision with one another being allowed to approach a junction at the same time. On other lines it is not so used, or is only used in the case of junctions approached on heavy falling gradients, or under other circumstances of extra risk. On some lines record-books or registers of the trains are carefully kept, and are found to be valuable safeguards against irregularities, the working of each signalman being checked by the record-book of the signalman on each side of him. On other lines record-books are not used. Certain railways are worked on the block system by bells only; others by bells and block instruments, so as to afford the aid and evidence of sight as well as sound to the signalmen; and others by bells, block instruments and speaking instruments. When the bell code includes a great number of indications, then the number of beats required, amounting to ten, or even fourteen and fifteen, become so numerous the men are liable to mistakes in counting them; and especially with the system sometimes employed of making, for instance, six beats mean one thing, and three beats twice repeated some other thing. It is, in any case, all important that the two indications "line clear" and "line blocked" (from whatever cause) should be entirely distinct from all other signals; and the necessity for this was demonstrated in a recent accident, one cause of which was that an acknowledgment signal was mistaken for a line clear signal. One important question in the working of block systems is, the particular time when line clear should be given after an engine or train has passed a section cabin or signal. The lengths of the sections vary, necessarily, according to the nature of the traffic and with local circumstances. They may be measured by miles in some cases, and by yards in other cases. Whatever their lengths, if one train has passed out of a section before another train is admitted to it, there must, at the period of admission of the second train, be an interval of space equal to the length of the

section between the two trains. But supposing the first train, on passing out of the section, to be brought to a stand immediately after passing the section signal, then the second train, being admitted to the section, may also run up to the section signal and to the tail of the preceding train, and the interval between the trains will be reduced to nil. An engine-driver overrunning a signal to only a slight extent may, in such a case, come into collision with a preceding train. Different companies meet this question in different ways. On some railways the line is considered clear when the last vehicle of a train has passed the section signal; on other lines this is the case except during fogs and snow storms; on others, again, different specified stations are differently provided for; and on other lines a difference is made in this respect between goods and passenger trains.

In the working of single lines by telegraph a risk is incurred which does not arise in the case of double lines. In the event of irregularities in the running of the trains, it becomes necessary to alter the crossing places of trains proceeding in opposite directions; and from time to time accidents have occurred in this country and elsewhere in consequence of misunderstandings in making such alterations. Such accidents led many years since to the establishment of, and to the preference by many for, the train-staff system of working single lines. In some cases a combination of train-staff and block-telegraph has been adopted, and this combination appears to afford, when it can be carried out, the greatest degree of safety. But the feeling in favor of working single lines by telegraph only appears again to have strengthened; and it must be admitted that it allows of greater freedom in dealing with the traffic, especially on lines of considerable length. Of all the difficulties that present themselves in railway working, the greatest is that of running trains in a fog. When the fog is so thick as to prevent the engine-drivers from seeing the signals, it then becomes necessary to inform them by other means of their condition; and, accordingly, plate-layers or porters are employed as fog-men to stand near the signals, to place detonating signals on the rails, and thus to inform the engine-drivers of the indications of the signals; or they convey in some cases verbal directions from the signalmen. The greatest difficulty and danger are incurred either when a fog comes suddenly on, and the fog-men are not at their posts, or when it lasts for a long time and the fog-men are required for duty for an excessive number of hours. The system is at best an unsatisfactory one. There are, then, many points worthy of discussion as to the best mode of carrying out the details in the working of the block system. It has been found essential on very crowded lines, in tunnels, and other places of extra risk. The outcry against it of those chairmen of railway companies who at the same time take credit for its adoption, and who are indebted to it for the comparative safety of the traffic on the most crowded portions of their lines, cannot be considered to be very serious. It promises at length, as the president of the institution has stated with apparent regret, to be universally adopted. The system of presumed time intervals has failed, because those intervals could not in practice be preserved; and the permissive system for reducing the time intervals by the aid of the telegraph, and sending trains timed to travel and capable of traveling at various speeds one after another, into the sections with a caution to each, may also be considered to have failed, because it does not afford sufficient protection to the traffic.

The safety of railway traffic from the great majority of serious accidents, namely, from various descriptions of collisions and from accidents in connection with facing points, thus depends mainly upon two classes of men, and upon the apparatus, the means and appliances, with which they are supplied. These two classes of men are the signalmen and the engine-drivers. The engine-drivers rely upon the signalmen to give the proper indications, by means of their signals, as to whether the lines are clear or obstructed, as to whether the points are right or wrong; and the signalmen rely upon the engine-drivers to look out for and obey the signals that are made to them. The safe working of the traffic in this respect depends, therefore upon a thorough understanding between these two classes of men. It depends, in fact, on the avoidance of mistakes, misapprehensions or neglect, (1) in the observation of signals by engine-drivers, (2) in the working of points and signals by signalmen, and (3) in the communications of signalmen with one another. In order to obtain the greatest degree of safety, it is necessary, as far as possible, to reduce the risk of such misunderstandings and neglect; or, in other words, pains must be taken to avoid confusion in working, and to substitute for it simplicity in working. Confusion in working must be more or less the consequence when rules and regulations are in force which cannot be carried out in practice—when hand-signals intended for one engine-driver may be received and acted upon by another engine-driver—when there is not a fixed signal for each purpose for which a signal is required—when signalmen or pointmen are obliged to run about station yards, at serious personal risk, to work points and signals, without being certain as to what train may next approach them or when it may be expected—when, having a number of levers without locking apparatus in or around the cabin, they are liable to pull the wrong signals and point levers over for an approaching train—when, in the absence of necessary means of communication, neighboring signalmen are liable to work at cross purposes with each other—when, in the absence of sufficient goods lines and sidings, station-masters and signalmen are compelled to allow the shunting, sorting and marshalling operations of goods trains to be performed on the passenger lines, or goods trains to be moved from one line to another, while passenger trains are due or overdue in one or both directions—when engine-drivers of through trains or stopping trains, at junctions and sidings, have not reliable signals, properly placed, to inform them distinctly, in each case, when they must stop or when they may go forward—when, under the permissive, or any other time system, they are told of trains being two, three, or any other number of minutes of time in front of them, without knowing how fast such trains may be able to travel, or what trains may similarly be allowed to follow them, and therefore what speed they should themselves maintain to avoid, on the one hand, a collision with a train in front, or, on the other hand, a collision with a train behind them—when, in long, heavy trains, timed to travel at high speed, they have not sufficient brake-power to enable them to bring it to a stand within a reasonable distance—when they cannot depend upon the guard hearing their brake-whistles, and have only a limited proportion of retarding power under their own control—when the lines cannot be kept clear for them at stations at which they are not due to stop—and when they find it difficult to maintain their time-table speed, and at the same time to approach each and every signal in the course of their journeys with the requisite amount of caution, according to the severity of the gradients, the slipperiness of the rails, the proportion of break-power, and the positions of and view afforded by such signals.

These elements of confusion in working, far from being theoretical or imaginary, have too often been practically illustrated by lamentable accidents on various systems of railways; and it is in the endeavor to avoid such confusion that the modern recommendations and requirements of the Board of Trade and its officers have gradually, as the result of experience over a great number of years in observing these causes of accidents, grown to their present condition. The object of these recommendations and requirements is to substitute simplicity for such confusion, as a means of greater safety and efficiency in working. Simplicity in working has thus been obtained in a very great number of cases, and has yet to be obtained in many other cases. It consists, as re-

wards signalmen, in affording to each signalman, by proper signal and point arrangements, complete control over the lines, sidings and traffic at his post; in preventing him from making such mistakes in the handling of his levers as may lead to accidents—mistakes which the most careful men are liable to commit sooner or later if they are not protected by locking apparatus, but which they are in a great measure prevented from making by such apparatus; in giving him sufficient warning of the approach of trains from different directions; in providing sufficient accommodations on lines and sidings to enable the main lines to be kept clear for the passenger trains. It consists, as regards the engine-drivers, in arranging that each shall have a distinct signal to look to for every necessary purpose, and that he shall have the means of properly obeying it, without any inducement to run risk in disobeying it. It cannot, of course, be expected, even when the utmost simplicity in working is arrived at, that there will be no more accidents to deplore, because, unfortunately, human agency must still be relied on, and human agency must always be, as it has ever been, fallible. So long as engine-drivers are men, they will occasionally run past signals; so long as signalmen are human, they will occasionally make mistakes and misunderstand one another. Neither the block system nor locking apparatus will, as the author has frequently stated, be a panacea for preventing railway accidents altogether; nor can any other improvements be expected to have such an effect. But it is equally certain that the number of serious accidents may be reduced and especially on certain railway systems, when all the improvements above referred to have been carried out. The risk of the mistakes of signalmen in working points and signals will have been in a great measure neutralized. Goods trains will not so much engage the passenger lines, and will not be engaged in shunting on them, and crossing from one main line to another, when passenger trains are due; and this of itself, by a simpler form of working, will tend to prevent a large proportion of accidents. Delays will thus be avoided, also, both to passenger and to goods trains, and greater efficiency in working will be obtained. And this is no mere matter of speculation, because greater safety and efficiency have been and are obtained on those railways or portions of railways on which such improvements have already been introduced.

The author next answers several of the objections which had been advanced against the improvements described in his paper, and, in conclusion, says: To sum up the whole case, it is necessary, in railway working, to deal with men and mechanism. Men are fallible, and mechanism may fail. The complications of railway construction and traffic have increased enormously, and are still increasing. At some points the lines, the sidings and the crossings are so numerous, and the traffic is so constant, that the employment of the best means and appliances is unavoidable. In other localities, of severe gradients or obstructed view, or when greater danger is otherwise incurred, similar means and appliances are also indispensable. These points and localities become more and more numerous, and ample experience has now been obtained as to the most efficient modes of working. The result of that experience has plainly demonstrated that mistakes and accidents may best be avoided, and efficiency of working may best be obtained:—By judicious selection and careful training of the men employed, and especially—in a safety point of view—of engine-drivers and signalmen. 2. By providing those men with reasonable and necessary apparatus and accommodation for the proper performance of their duties. 3. By maintaining good discipline among them, which is only feasible when proper means and accommodations are provided, when proper modes of working are adopted, and when it is possible for them to carry out in practice the rules and regulations furnished for their guidance. These three desiderata include the provision of fixed signals in sufficient number to enable the signalmen to afford due warning in each case in which warning is required to the engine drivers, and to enable the engine drivers clearly to understand the warnings so given to them. They include the supply of locking and other apparatus, which has been proved to act efficiently in preventing or neutralizing the mistakes, in the working of points and signals, which the best of men are otherwise, sooner or later, almost certain to commit. They include the addition of sufficient lines and sidings to enable the traffic to be properly worked—without goods or mineral trains constantly obstructing the passenger lines, without the main lines being blocked when fast through trains are due or may be expected, without excessive delay to slow or goods trains in waiting for fast or passenger trains to pass, without stopping trains being shunted from one main line to another to allow fast trains to pass them, without habitual unpunctuality. They include the necessary apparatus for enabling intervals of space to be preserved between running trains, and the proper arrangement and working of such apparatus, with the careful adaptation of it to local circumstances. They include the provision of ample retarding power in the trains, applicable at the will of the engine driver, to enable him to obey the signals which he receives, and to bring his train to a stand within a reasonable distance. They include, in fine, all those things which contribute to simplicity, and which tend to the avoidance of that great cause of extravagance, inefficiency and danger—confusion in railway working.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

The following changes have been made in the officers of the Atlantic & Great Western Railroad Company: Mr. Thomas Warnock, heretofore Auditor, is appointed Secretary also, in place of A. Hegewisch, resigned, and Mr. F. E. Pitman has been appointed Treasurer. The offices of both will be at Meadville, Pa., to which place the Accounting Department is removed from New York. Mr. S. F. Uhlhorn has been appointed Assistant Secretary, with office in New York.

Mr. William Hill has been appointed Master Mechanic of the Third and Fourth Divisions, in place of C. W. Butt, resigned. His office is at Galion, Ohio.

The directors of the Lafayette, La Salle & Clinton Railroad Company have elected the following officers for the ensuing year: President, Col. Milo Smith, Clinton, Ia.; Vice-President, S. B. French; Treasurer, T. D. Brewster, Peru, Ill.; Secretary, Daniel Smith, La Salle, Ill.

Maj. N. L. Morril, of Evansville, Ind., has been appointed by the receivers Superintendent of the Cairo & Vincennes Railroad.

The Commission of Engineers to examine and report on the mouth of the Mississippi River is composed of the following gentlemen: Gens. White and Alexander and Col. Comstock, of the United States Army; Prof. Mitchell, of the Coast Survey; W. Milnor Roberts, Chief Engineer Northern Pacific; T. E. Sickle, Chief Engineer Union Pacific Railroad; J. D. Whitecomb.

The board of directors of the Pennsylvania Railroad, at a special meeting in Philadelphia, June 29, elected the following officers: Second Vice-President, Edmund Smith; Third Vice-President, A. J. Cassatt; General Manager, Frank Thomson; Assistant to the President, John P. Green; General Superintendent Delaware & Baratarian Canal, Gen. I. J. Wistar.

The First Vice-President, Mr. George B. Roberts, will have charge of all engineering operations connected with the construction or extension of any of the company's lines, and a

general supervision over the accounts of the company through the Comptroller. Mr. Edmund Smith, the new Second Vice-President, entered the service of the company as an Engineer in 1847, was made Secretary in 1855, Third Vice-President in 1869, and Treasurer on the retirement of Major Firth, last year. He will take charge of the finances of the company, not only of the Pennsylvania Railroad proper, but of all the lines in which the company has a controlling interest. Mr. Smith will continue to act as Treasurer until his successor is chosen.

Mr. Cassatt, the Third Vice-President, has been in the employ of the company since 1859, has been Resident Engineer and Assistant General Superintendent of the Philadelphia & Erie; Superintendent of Motive Power and General Manager since 1871. He will have a general charge of the transportation department, also of the freight and passenger departments, and of the rates for the transportation of freights and passengers. He is specially charged with the relations of the company with competing and connecting railroad lines in reference to the traffic, thereby retaining some of the more important of his former duties as General Manager, relieved of details.

Mr. Frank Thomson, the new General Manager, served as an apprentice in the Altoona shops. During the war he was connected with the military railroad service. He was for some years Superintendent of the Eastern Division of the Philadelphia & Erie, and was transferred to the Pennsylvania as Superintendent of Motive Power in 1873. He will have charge of the operation of the lines east of Pittsburgh and Erie.

Mr. Green has been for some time Secretary to Mr. Scott. Mr. Strickland Knase still remains Assistant to the President, Mr. Green's appointment being additional. Mr. Wilson, as Consulting Engineer, is charged with the general care of all the real estate of the company, in addition to his duties in the engineering department. General Wistar is President of the Pennsylvania Canal Company.

The Governor of Massachusetts has reappointed Mr. A. D. Briggs, whose term had expired, a member of the Board of Railroad Commissioners for another term.

Mr. George Colbridge, late of the New York Central & Hudson River road, has been appointed Train Dispatcher on the Morris & Essex Division of the Delaware, Lackawanna & Western Railroad, in place of Wm. F. Agnew.

At the annual meeting of the Nashua, Acton & Boston Railroad Company recently the following directors were elected: H. Parkinson, B. Saunders, Dana Sargeant, Nashua, N. H.; John C. Moulton, Laconia, N. H.; Joseph C. Clark, Manchester, N. H.; J. Fletcher, Jr., Acton, Mass.; J. T. Burnap, Dunstable, Mass.; Charles G. Sargeant, Graniteville, Mass.; Peter B. Brigham, Boston. The board subsequently elected Peter B. Brigham, President; John C. Moulton, Vice-President; Charles B. Goodrich, Boston, Clerk; F. D. Cook, Nashua, N. H.; Treasurer; S. Mansfield, Superintendent.

Mr. R. G. Rombauer has been appointed Auditor of the Memphis, Carthage & Northwestern Railroad, in place of J. A. Hardin.

Mr. H. H. Marshall has been appointed General Freight Agent of the Boston, Barre & Gardner Railroad. Mr. H. C. Spaulding, heretofore General Freight and Ticket Agent, will be hereafter General Ticket Agent only.

The directors of the Baltimore & Drum Point Railroad Company have re-elected D. R. Magruder, President, and Wm. R. Hutton, Vice-President. Robert W. Yoe, of Calvert County, Md., has been chosen a director to fill a vacancy. The Executive Committee consists of F. L. Barreda, New York, Chairman; D. R. Magruder, W. R. Hutton, James Webb, Andrew J. Banks and James Cheston.

Col. H. B. McComb has been chosen President of the new New Orleans, St. Louis & Chicago Railroad Company, formed by the consolidation of the Mississippi Central and New Orleans, Jackson & Great Northern. He was President of both companies.

Mr. L. H. Meyer, of New York, is Chief Engineer of the Michigan & Ohio Railroad.

It is reported that Mr. William Williams, of Buffalo, will succeed Amasa Stone, Jr., as Managing Director of the Lake Shore & Michigan Southern Railway.

A meeting of the stockholders of the Illinois, Missouri & Texas Railroad Company was held in St. Louis, Mo., June 30, and the following directors elected for the ensuing year: Gen. John McDonald, C. E. Candeo, D. J. Hynes, J. W. Coulogue, T. C. Fletcher, W. W. Mann, T. D. Price, Harry Landre, E. J. Crandall.

The directors of the Canton Company met in Baltimore June 30 and elected the following officers for the ensuing year: Charles J. Baker, President; George S. Brown, Vice-President; W. W. Janney, Secretary and Treasurer; Col. Wm. Kinnard, Agent; Executive Committee, George S. Brown, Alex. B. Baylis, William Mertens and William G. Harrison; Committee on Accounts: Charles Weber, S. Spragg Bell and James B. Colgate.

Mr. John W. Warren has been appointed Master Mechanic of the Springfield & Illinois Southeastern Railroad, with office at Pana, Ill., in place of J. J. Ladd, resigned.

TRAFFIC AND EARNINGS.

The anthracite coal tonnage of the lines given (whose year begins December 1) for the seven months ending June 27, was as follows:

	1874.	1873.	Inc. or Dec.	P. c.
Philadelphia & Reading...	3,223,722	3,216,272	Inc. 13,450	0%
Schuylkill Canal...	313,721	274,705	Inc. 38,956	14%
Lehigh Valley...	2,273,627	2,202,659	Inc. 70,968	3%
Pennsylvania & N. Y.	396,923	360,976	Inc. 34,047	9%
Totals	6,312,098	6,064,672	Inc. 157,421	2%

The anthracite coal tonnage of the lines given for the six months ending June 27, was as follows:

	1874.	1873.	Inc. or Dec.	P. c.
Del. Lack. & West. Rn.	1874.	1873.	Inc. 32,598	8%
Northward.....	341,671	373,627	Dec. 32,598	8%
Southward.....	974,772	1,133,866	Dec. 159,094	14%
Totals	1,316,801	1,507,493	Dec. 191,692	12%

The anthracite coal tonnage of the lines given for the six months ending June 27, was as follows:

	1874.	1873.	Inc. or Dec.	P. c.
Del. Lack. & West. Rn.	1,181,290	1,240,820	Dec. 59,530	4%
Del. & Hudson Canal Co.	1,231,671	1,422,987	Dec. 191,316	13%
Pa. Coal Co., by Erie R'y	587,624	555,711	Inc. 31,913	5%
Shamokin Div., Northern Central.....	238,527	275,521	Dec. 36,994	13%
Summit Branch.....	191,303	187,979	Inc. 3,324	1%
Totals	4,746,216	5,190,511	Dec. 444,295	8%

During the month of June the Baltimore & Ohio Railroad delivered the following number of loaded cars in the freight yard at Locust Point, opposite Baltimore:

	1874.	1873.	Inc. or Dec.	P. c.
Coal cars (11½ tons each).....	13,861	—	—	—
Grain cars.....	2,072	—	—	—
Cars miscellaneous freight.....	3,612	—	—	—
Total cars	19,445	—	—	—

The earnings of the Grand Trunk Railway for the week ending June 13 were: 1874, £41,600; 1873, £37,700; increase, £3,900, or 10% per cent.

The earnings of the Illinois Central Railroad for June were: 1874, \$678,728; 1873, \$742,00; decrease, \$63,872, or 8% per cent.

The tonnage of Cumberland coal over the different lines for the six months ending June 27 was as follows:

	1874.	1873.	Inc. or Dec.	P. c.
Baltimore & Ohio.....	694,055	646,801	Inc. 47,254	7%
Cheapeake & Ohio Canal.....	262,962	241,779	Inc. 21,183	8%
Bedford Div. Penna. R. R.	45,584	41,136	Inc. 4,448	10%
Totals	1,002,61	929,716	Inc. 72,885	7%

The bituminous coal tonnage of the lines given was as follows for the six months ending June 27:

	1874.	1873.	Inc. or Dec.	P. c.
Huntingdon & Broad. Top.....	160,116	228,510	Dec. 69,394	26%
Cleardale coal over Tyrone, Division, Pennsylvania R. R.	297,777	269,487	Inc. 28,290	10%
Penn. & N. York (seven mos.)	15,250	16,045	Dec. 12,909	7%
Totals	517,939	661,012	Dec. 43,983	6%

The coal tonnage of the Pennsylvania Railroad for the six months ending June 27, was:

	1874.	1873.	Inc. or Dec.	P. c.
Coke (tons of 2,240 pounds).....	1,273,052	236,479	—	—
Total.....	1,509,531	—	—	—

Being 150,933 car loads, or about 5,000 trains.

The earnings of the Indianapolis, Bloomington & Western Railway for 1873, as reported to the Secretary of State of Indiana, were:

	1874.	1873.	Inc. or Dec.	P. c.
Earnings (\$4.99 per mi. e).....	1,593,747.48	966,854.85	—	—
Expenses (60.67 per cent.).....	—	—	—	—
Net earnings (\$1,965 per mile).....	1,626,892.63	—	—	—

The Buffalo Commercial Advertiser gives the following statement of receipts of flour and grain in that city for the six months ending July 1:

	1874.	1873.	Flour.	Grain.	Flour.	Grain.
By railroad.....	1,023,727	15,237,369	11,875,140	—	—	—
By lake.....	412,480	18,250,517	15,591,685	—	—	—
Totals	1,436,216	33,487,876	331,597	27,466,825	—	—

The shipments of grain eastward for the same period were:

	1874.	1873.	Flour.	Grain.
By canal, bushels.....	13,003,845	10,140,918	—	—
By rail.....	4,358,838	3,233,654	—	—
Totals	17,351,703	13,373,972	—	—

The receipts of canal tolls on the Erie Canal at Buffalo, from the opening of the season up to July 1, were: 1874, \$388,509; 1873, \$320,944; increase, \$67,565, or 21 1-16 per cent. The number of boats cleared was: 1874, 2,412; 1873, 2,038; increase, 374, or 18% per cent.

The earnings of the Great Western Railway of Canada for the week ending June 19 were: 1874, £19,925; 1873, £25,742; decrease, £5,817, or 22% per cent.

The earnings of the Grand Trunk Railway for the week ending June 20 were: 1874, £38,300; 1873, £36,100; increase, £2,200, or 6% per cent.

The earnings of the Great Western Railway of Canada for the week ending June 12 were: 1874, £21,042; 1873, £25,830 decrease, £4,788, or 18% per cent.

The earnings of the Central Pacific Railroad for June were: 1874, \$1,380,000; 1873, \$1,301,202; 1872, \$1,138,272; increase, 1874 over 1873, \$78,793, or 21 1-16 per cent.; increase, 1874 over 1872, \$241,728, or 21% per cent.

For the six months ending June 30 the earnings were: 1874, \$6,407,026; 1873, \$6,325,408; 1872, \$5,503,616; increase, 1874 over 1873, \$81,618, or 1% per cent.; increase, 1874 over 1872, \$898,410, or 16% per cent.

PERSONAL.

Hon. Thomas H. Herring, one of the original projectors of the Northern Railroad of New Jersey, and for some years President of that company, died at his residence in English Neighborhood, N. J., July 1.

Mr. William F. Doggett, Cashier of the Pittsburgh, Cincinnati & St. Louis Railway, died recently in Chicago. He was formerly for 10 years Secretary and Treasurer of the Indiana Central Company and later its Auditor. He had held his last position for three years and had been employed by railroad companies for 22 years.

Mr. William Wilcox, Superintendent of the Shore Line Division of the New York, New Haven & Hartford Railroad, was killed by an accident to a train on his division at Stony Creek, Conn., July 7. The train was thrown from the track, and as Mr. Wilcox, who was standing in the door of the baggage car, jumped to the ground, the car upset and fell on him, killing him instantly. He had been a conductor on the road for many years and was appointed Division Superintendent in the fall of 1872, succeeding Mr. S. H. Scranton.

It is stated that Mr. Amasa Stone, Jr., some time since tendered his resignation of the position of Managing Director of the Lake Shore & Michigan Southern Railway Company, to take effect July 1, and that he is now only holding office until his successor is appointed. Mr. Stone, it is understood, resigns because his private business requires his attention, which he is unable to give it while he holds his present position.

Mr. Anson S. Marshall, a prominent lawyer of Concord, N. H., and for many years Clerk of the Concord Railroad Company, was accidentally shot, July 4, and died the following day.

THE SCRAP HEAP.

Railroad Manufactures.

The East St. Louis Rolling Mill, which has been lying idle for two years past, has been leased by a co-operative company which will commence work as soon as the necessary repairs can be made

the port of New York during the month, nor have there been during the first half of 1874, the imports for the first half of 1873 having been 33,817 tons. Of steel 12,996 tons were imported in June and during the six months 45,063 tons, against 42,517 in 1873. Old rails are quoted at \$37 currency for double-heads with 640 tons imported in June and 1,289 in the first half this year, against 8,534 in 1873. The firm's circular says that transactions in foreign during the month were limited to trifling lot, and that little was done in America, 1,000 tons of 52 lbs. hypothecated rails having been sold at about \$56 cash.

The Largest Engine.

The Pittsfield (Pa.) *Journal* says: "The largest locomotive in the world is the Pennsylvania, on the Philadelphia & Reading Railroad. The diameter of the cylinder is 20 inches, the stroke 26 inches, the number of driving wheels twelve, the diameters of the drivers four feet, the weight of the engine alone 60 tons."

This statement, however, is not exactly correct. Winsans, in Baltimore, built some engines with cylinders 22 by 22 inches, and we believe a Norris engine on the Reading road had 24-inch cylinders. The Fairlie engine Janns, built by Mr. Mason, and now on the Lehigh Valley, weighs 72 tons, and has four 15-inch cylinders.

Long Trains.

The Utica (N. Y.) *Herald* of June 29 says: "Thursday, the locomotive D. S. Dickinson, on the Delaware, Lackawanna & Western road, Michael Sullivan, engineer, pulled 180 coal jimmies from Chenango Forks to Great Bend, Pa., 11 miles."

Promoting a Conductor.

Speaking of some recent arrests of conductors for embezzlement, the Hartford (Conn.) *Courant* of recent date says:

"The last important case of this sort which occurred in New Haven was when a conductor was suspected of taking more than his allowance through a discovery that he had bought real estate in New Haven and was having plans drawn by an architect for a fine residence. But he never was, however, spoken to on the subject. The President of the road sent for him and complimented him on his splendid service as a conductor, and then announced to him in flattering terms that he had been promoted to the position of ticket agent at one of the stations on the road with an increase of twenty-five dollars on his monthly salary. Being a promotion he could not refuse it, even though he did not feel flattered. He accepted and served faithfully, but the East Haven lot was never improved by him, and the architect's plans were not needed."

Cincinnati Industrial Exposition.

This exhibition, which is now widely known as one of the best, best-managed and most visited of industrial fairs in this country, will open this year September 2 and close October 3. The grounds will be opened for the reception of articles from August 3 to September 1. Among the premiums offered of the most interest to our readers are those in Class No. 1, (Steam-Engines, Boilers, Steam Pumps, Steam Hammers and all Apparatus operated directly by Steam); Class No. 2, (Steam Boiler and Engine Fittings, including Heaters, Governors, Safety Valves, Steam Gauges, Water Gauges, Low and High Water Alarms, Grate Bars and Appliances); Class No. 5, (Machinists' Tools and General Metal Working Machinery); Class No. 7, (Wood-Working Machinery); Class No. 25, (Iron, Steel, etc.); Department D, (Railroad Supplies, including Couplings, Rail-joints, etc.) Under the latter premium are offered for the following: Best display of railroad supplies locomotive head-light, spun-work for domes, cylinder heads, etc.; automatic brake; switch; frog; car-heater; car-ventilators, lamps for passenger-cars; car-lifter; car springs; car-seat springs; freight car and switch padlocks; door locks and latches for railroad cars; car-coupling; railroad joint. The exhibition of articles here is likely to be well worth the while of manufacturers from all parts of the country, and especially of those who sell or hope to sell their goods in Ohio, Kentucky, Tennessee, Indiana, Illinois & Missouri.

OLD AND NEW ROADS.

Texas & Pacific.

The bill recently passed by Congress authorizing this company to make a change in the existing mortgages simply empowers the company to secure the construction bonds heretofore issued by mortgage on the whole or any part of the line, and to cancel the mortgage now on record so far as can be done without prejudice to existing rights. The mortgages securing the construction bonds shall be substituted for the existing mortgage, with a special reservation of existing rights under the same, and the amount shall not exceed the amount heretofore authorized by law. Said mortgages for the division east of Fort Worth shall embrace the property of the Southern Pacific and Southern Transcontinental companies, which have been merged in the Texas & Pacific under the laws of Texas. These roads shall be considered part of the Texas & Pacific and subject to all the acts of Congress concerning that company.

Great Western, of Canada.

The report of the Committee of Investigation appointed by the stockholders at the meeting of last October has been published in the English papers. The report is very long and the general tone of it is decidedly unfavorable to the present management.

Much fault is found with the rapid increase of the capital account during the last four years. This increase during the 10 years ending with 1869 was only \$258,932, while during the four years ending last January it was \$2,616,300, and a further increase of \$500,000 has been authorized, which will make the total \$8,603,737. The committee believes a large part of this was unnecessary. During the same period, with a large increase of gross earnings, there has been a still greater increase of working expenses and interest, so that the amount available for dividends has been reduced from 6% to 2% per cent. on the stock.

As to the road itself, the committee's engineer reports that the main line has been laid with steel, but is not in the condition in which it should be. The grades on the new Glenoe loop line are not as favorable as was represented, and a considerable expenditure is still needed on that line.

The failure of the negotiations with the Grand Trunk for the use of the International Bridge have rendered the 45 miles of the Loop Line from Canfield to Fort Erie almost useless, and have made necessary the building of the Allanburgh Branch and the lease of the Welland Railway. The latter lease has most onerous conditions, and the road is in very poor order.

The Wellington, Grey & Bruce, while likely to be a valuable feeder, is very poorly built, and the terms of the lease are condemned as being unfavorable to the lessee. Almost the same remarks are applied to the London & Port Stanley line.

A sketch is given of the relations of the company with the Detroit & Milwaukee, and the plan proposed for the reorganization of that company is not approved. It is deemed best to postpone for the present any further recommendations on this point.

The management of the London office by the Secretary, Mr. Brackstone Baker, is commended, but much fault is found with the board for the manner in which its minute book has been kept, and it is charged that certain books have been used for stockjobbing purposes, and that the board has failed to keep its promise to publish promptly on their receipt the monthly returns of receipts and expenditure. There has been much lack of system in the fuel department, and the account of old

rails has been very loosely kept. The charging of the whole amount of steel rails laid down in the last half-year, instead of spreading it over the whole year, is not approved, and the committee considers the use of steel on the Toronto Branch entirely unnecessary.

The present system of agencies and commissions is condemned, and the committee considers that something should be done to put an end to the unremitting rates on through traffic which are now in force.

In conclusion, the committee declares its belief that great changes must be made in the management. The past policy has been of serious error in management, of waste and extravagance. A great property has been seriously injured, and it will require time and careful management to repair the mischief already done.

Fixing Freight Rates.

Representatives of the trunk lines held a meeting in New York last week, which continued for several days. The object of the meeting was to regulate rates both eastward and westward, and it was reported that a plan was under consideration for the appointment of a board of commissioners, whose duty should be to fix rates on all through freights, and whose decision should be both binding and final. Nothing definite has been made public as to the decision of the meeting, and the only result thus far has been an increase in stock rates.

Railroad Taxation in New Jersey.

The State Commissioner of Railroad Taxation in his annual report to the Comptroller returns the assessed value of railroad property liable to taxation at \$16,755,523, an increase of \$526,900 over last year. Most of this increase is due to the fuller returns made by local assessors, the law last year having been new. Of the increase in valuation \$215,973 is on property owned by the Erie, \$101,850 on the Morris & Essex, \$18,350 on the Montclair, and \$3,800 on the New Jersey West Line. The law exempts the land occupied occupied by the main line, not exceeding 50 feet in width, and 10 acres at each terminus.

Boston, Concord & Montreal.

This company has just completed and opened for travel an extension of its Twin Mountain Branch from the Twin Mountain House to the Fabyan House, six miles. The branch is now 15 miles long from the main line at Wing Road, N. H., to the Fabyan House. It is built to accommodate the summer travel to the White Mountains.

Hempstead & New York.

The trustees under the mortgage have commenced a foreclosure suit against this company. The road completed is 5½ miles long, from the South Side at Valley Stream, Long Island, to Hempstead, and it has been leased and worked by the South Side Company.

Syracuse Northern.

The Syracuse (N. Y.) *Journal* of recent date says: "The parties in the interest of the Rome, Watertown & Ogdensburg, and Delaware, Lackawanna & Western railroads, to whom a large majority of the second and third-mortgage bonds of the Syracuse Northern Railroad were recently transferred, have already commenced making such expenditures for the benefit of the road as were stated by the officers of the road at a meeting recently held in this city to be necessary. One thousand tons of new rails have been ordered for the construction of branches and improvement of the track. * * *

Surveys and estimates for a railroad from Baldwinsville to Mexico have been made, to connect the Oswego & Syracuse Division of the Delaware, Lackawanna & Western and the Rome, Watertown & Ogdensburg railroads. We have information which leads us to believe that the work of constructing the road has been, at least, temporarily and probably permanently postponed, on account of the transfer above referred to."

Minnesota & Northwestern.

There is still a prospect of the completion of the line from Mankato, Minn., to Wells, and a small force has been set at work repairing the old grade where the weather has injured it.

Baltimore & Ohio.

The new elevator at Locust Point, opposite Baltimore, was opened July 1.

An event of some importance to the company is the completion of the new ship channel into the harbor of Baltimore. This channel has a depth of 24 feet at mean low water and a minimum width of 250 feet, and will remove the difficulty which the largest class of vessels have heretofore found in reaching the wharves. It has cost \$700,000, of which \$300,000 was paid by the United States, the rest by the city. The grain traffic of the road is largely increasing, the two steamship lines from Baltimore to Europe taking full loads of grain on each trip, and the number of trips of both lines having been lately increased.

Work on the Short Line, or extension of the Wheeling, Pittsburgh & Baltimore from Washington, Pa., to the Pittsburgh, Washington & Baltimore, near Layton's, is being pushed forward. A large force is employed near Belle Vernon, where the road crosses the Monongahela, and there is some pretty heavy work.

Easton & Amboy.

The work of tracklaying and finishing up the eastern section of the road progresses steadily. It is not known whether the company intends to open this portion of the line for business at once or to wait until the whole road is completed.

The Phillipburg Manufacturing Company has a contract for several of the bridges on the line.

Berks County.

The road was formally opened from Reading, Pa., through to Slatington, July 1, by an excursion over the line, and an inspection by the officers of the company.

Okolona & Grenada.

Iron for the first five miles westward from Okolona, Miss., has been delivered and will soon be put down. Enough has been secured to lay the track to Houston, 20 miles southwest of Okolona. The road is of narrow gauge.

Indianapolis, Bloomington & Western.

This company last week filed its annual statement for 1873 with the Secretary of the State of Indiana. From this statement, which is required by law and which is the only one made public by the company, the following figures are taken: Gross earnings (\$4,900 per mile) \$1,593,747.48 Expenses (60.67 per cent.) 966,884.85

Net earnings (\$1,965 per mile) \$626,892.63

The passenger train mileage for the year was 647,197; freight train, 2,732,721; other train, 140,115; total train mileage, 1,961,038 miles. The principal items of freight were 10,162,954 bushels of grain, 66,996 tons of coal, 40,830 tons of stock, 38,264 tons lumber and 86,964 barrels of flour.

The equipment consisted of 73 engines; 25 passenger and 15 baggage and mail cars; 1,315 box, 175 stock, 289 coal and 90 flat cars. The cost of construction and equipment was \$14,392,650, and the stock and debt was as follows:

Capital stock, authorized, \$15,000,000, issued (\$17,027 per mile) \$5,687,500

Funded debt (\$19,461 per mile) 6,500,000

Floating debt 568,810

Total \$12,756,310

The Iowa Railroad Law.

The railroads of Iowa have been classified as follows under the new law by the Executive Council of the State:

Class A. Burlington & Missouri River and branches; Chicago & Northwestern and branches, including Iowa Midland; Chicago, Rock Island & Pacific, including Chicago & Southwestern; Illinois Central lines.

Class B. Central of Iowa; Keokuk & Des Moines; Des Moines & Fort Dodge.

Class C. Sioux City & Pacific; Burlington, Cedar Rapids & Dubuque; Chicago, Dubuque & Minnesota; Dakota Southern; Davenport & St. Paul; Dubuque, Southwestern; Iowa Eastern; Milwaukee & St. Paul; Mississippi Valley and Western; Missouri, Iowa & Nebraska; St. Louis & Cedar Rapids; Sioux City & St. Paul, and all other roads not included in any other class.

Springfield, Athol & Northeastern.

A committee of the Springfield (Mass.) Common Council has been investigating the affairs of this company and reports that the stock is now \$10,000 (\$17,234 per mile) and the bonded debt \$600,000 (\$12,766 per mile). The cost of the extension from Barrett's to Springfield was \$600,000, very nearly, or \$35,820 per mile. Of this the city contributed \$300,000, and owns that amount of stock. The earnings for the last nine months are reported at \$58,500, the expenses \$36,200 and the net earnings \$22,300, or some \$10,000 less than the interest on the debt for that period. The Springfield Extension however was open for only six months of that time.

New York & Oswego Midland.

The committee of bondholders appointed at the meeting in Utica has made a report. The committee attended the meeting held in New York, June 19, and were well received. The committee on reorganization appointed by that meeting is approved by the Utica committee, and it is recommended that bondholders keep their bonds, at least until a practicable plan of reorganization can be arranged. The bonds cannot well be worth less than they are now, and it is possible that their value may increase.

St. Louis Union Depot.

The St. Louis City Council has passed the ordinance giving the Union Depot Company authority to lay the tracks needed to give the different roads entering the city access to the depot. The company is required to build the depot within two years and to give security that it will comply with the terms of the ordinance. It is also required to contribute \$20,000 of the cost of constructing certain street bridges which will be needed.

Dividends.

Dividends have been declared by the following companies: Central of New Jersey, 2½ per cent., quarterly, payable July 20.

Lehigh Valley, 2½ per cent., quarterly, payable to women only July 13, to others July 14.

West Chester & Philadelphia, 4 per cent., payable July 10.

Meetings.

The following companies will hold their annual meetings at the times and places given:

Erie, at the office, corner Eighth avenue and Twenty-third street, New York, July 14, from 10 a. m. to 2 p. m.

Raleigh & Gaston, at Raleigh, N. C., July 16.

Grand Junction.

It is stated that the iron has been purchased for 25 miles of this road, from Belleville, Ont., on the Grand Trunk, northwest to Campbellford. Work has been commenced on this section.

Philadelphia & Reading.

This company issued in London, June 30, through the banking house of McCalmont, Brother & Co., a sterling loan of £2,000,000 (\$10,000,000) at 90.

Savannah & Memphis.

The road is completed, and trains are running to Alexander City, Ala., 10 miles northwest of the late terminus at Salisbury, and 52 miles from Opelika, the southeastern end of the road.

Memphis, Fort Scott & Western.

This project has been revived, and it is now proposed to commence work at once on a 20-mile section from Fort Scott, Kan., southeast to Leroy in Barton County, Mo.

Detroit, Lansing & Lake Michigan.

This company has made arrangements with the Grand Rapids & Indiana by which trains are run through from Detroit to the termini of the latter road at Petoskey, on Little Traverse Bay, or to Traverse City. At these places connection is made with steamboats for Mackinaw and Escanaba.

North Carolina.

W. A. Graham, trustee, gives notice that he will redeem \$40,000 of the mortgage bonds of this company on presentation to him at the National State Bank, Raleigh, N. C., at any time previous to August 15.

Valley, of Virginia.

Work on the line through Botetourt and Roanoke Counties is progressing steadily. In Botetourt there is some heavy work, which will require considerable time to complete.

The City Treasurer of Baltimore paid over to the company, July 1, another instalment of \$50,000. Three more monthly instalments of \$50,000 each are required to complete the city's subscription of \$1,000,000.

Stock Freights.

The managers of the Pennsylvania, New York Central and Erie have agreed to advance and pool stock freights from the West. The new rates, which took effect July 6, provide for a rate of 55 cents per 100 pounds from Chicago to New York; 57½ cents from East St. Louis to New York; 57½ cents from Jeffersonville to New York; 50 cents from Cincinnati to New York, and in proportion from other points. Philadelphia rates are five cents per 100 pounds less than to New York, as usual on low classes of freight.

Pittsburgh, Washington & Baltimore.

The Baltimore *Gazette* says: "We are informed that this company continues as heretofore unable to meet the interest falling due on its bonds, but we are authorized to state that the coupons of the first-mortgage bonds due July 1 will, as formerly, be purchased by the Baltimore & Ohio Railroad Company, on presentation at the Merchants' National Bank."

Washington City & Point Lookout.

Congress, before adjourning, passed the bill authorizing this company to construct its road to Georgetown by way of Piney Branch and Rock Creek to Water street, thence to the Little Falls of the Potomac, with the right to bridge that river above navigation, so as to connect with the Washington & Ohio Railroad. Work is to be commenced as soon as the right of way can be secured.

Springfield & Illinois Southeastern.

Notice is given that John Sherwood has been appointed by the United States Circuit Court a special master to take evidence as to the names of all holders of bonds of the Springfield & Illinois Southeastern Railway Company and the amounts due to them. Holders of bonds are requested to ap-

pear at Mr. Sherwood's office, No. 60 Wall street, New York, and give the necessary proofs, in order that the master may make his report and the Court enter a final decree of foreclosure and sale.

A decree of foreclosure was entered on behalf of the trustees at Springfield, Ill., July 3. Under this decree if the arrears of interest are not paid up within 30 days the road will be sold without redemption.

Illinois & St. Louis Bridge.

The formal test of the bridge was made July 2, and is reported as follows, by Capt. James B. Eads, Chief Engineer:

The following is a summary of the result of tests made upon the Illinois & St. Louis bridge to-day with fourteen locomotives:

Seven locomotives were placed upon one track of each span. This produced a deflection of $2\frac{1}{2}$ inches on center span and $2\frac{1}{2}$ inches on each side span.

Seven locomotives were then placed on each track of the west approach and both trains of locomotives, fourteen in all, were moved out abreast, and simultaneously over each one of the three spans. The locomotives weighed from 35 to 51 tons, averaging 40 tons each, making 560 tons in all.

The two trains thus formed were stopped on each span and the effect of this load carefully noted.

The deflection of the middle span was $3\frac{1}{4}$ inches; of each side span 3 inches.

The two trains moving abreast upon each arch was the severest possible test to produce distortion of the curve of each arch.

Ten locomotives were then coupled together and these were run over each track on each side of each arch of the entire bridge, covering the entire track of each span and throwing the whole weight of the train, 400 tons, on one side of each span. This test was applied to each side of the bridge and produced the severest twisting strain to which each arch can be subjected. The vertical deflection produced by this test on the center span was $2\frac{1}{2}$ inches.

The locomotives thus coupled were run at a speed of ten miles per hour. The local traffic on the upper roadway of the bridge was uninterrupted during the progress of the tests.

Various other observations in detail were made noting the effects of the load on the arches as it entered upon and left the different spans, but this possesses no special interest to the general public. The result of the tests agree almost exactly with the theoretical computations previously made, and the whole trial proved eminently satisfactory.

The instruments failed to detect any side motion whatever during the tests.

The formal opening of the bridge took place July 4, with a celebration which is said to have been very fine and to have passed off very successfully. The first train to pass over the bridge and through the tunnel to the depot in St. Louis consisted of three locomotives and fifteen passenger cars, filled with invited guests. There was a procession, speeches by Capt. Eads, the Governor of Missouri and others, a banquet, and in conclusion a display of fireworks from the bridge itself.

Flushing & North Side.

An agreement of consolidation has been made by the directors of the Flushing & North Side, the Central of Long Island, the Central Extension, the Whitestone & Westchester, the North Shore, the North Shore & Port Washington and the Roslyn & Huntington Railroad companies. The agreement provides for a complete consolidation of the seven companies into one, which is to be called the Flushing, North Side & Central Railroad Company. It will be submitted to the stockholders of the various companies at meetings to be held in New York July 20, and as the controlling interest in all of them is held by the same parties there is no doubt that it will be ratified. In addition to the lines now owned the intention is that the consolidated company shall construct an extension of the present line to Great Neck, from Brookdale eastward to Northport, with a branch from near Manhasset to Sand's Point. With these lines the consolidated company will own about 90 miles of road.

Virginia & Truckee.

Surveys will shortly be begun for a branch from the head of Summit Flume, Nev., to Lake Bigler. The distance in a straight line is three miles, but as there is a rise of 800 feet in that distance the branch will follow a circuitous line and will probably be about eight miles long. It will open a heavy timbered country.

Poughkeepsie & Eastern.

A meeting of bondholders was held in Poughkeepsie, N. Y., at which it was stated that the floating debt amounted to \$112,790. A committee was appointed to consider a plan for settling the company's affairs.

Missaquoi & Clyde Rivers.

An effort is being made to complete the eastern section of this road, from Newport, Vt., the present terminus, east to the Grand Trunk at Island Pond, Vt. This extension will be about 20 miles long, on which there will be five miles of 50 feet grade to the mile and of somewhat difficult construction, while the rest of the line will be nearly level and easily built. When this section is built the road will form, in connection with the Grand Trunk (Portland to Island Pond) and the Missaquoi road (Richford to St. Albans) a line from Portland to Lake Champlain, somewhat longer than the Portland & Ogdensburg road, but with the advantage over that road that it will avoid the heavy grades through the White Mountains. The distance from Portland to St. Albans by this line will be 228 miles.

Alabama & Chattanooga.

This road was offered for sale by the commissioners at Mobile, Ala., July 6. The only bid put in was one for \$3,000,000, and that being less than the minimum price fixed by the Court, the sale was adjourned to October 5.

The Chattanooga (Tenn.) Times of June 30 says: "We were shown yesterday a dispatch from the Clerk of the United States Court at Mobile to some gentlemen in this city, stating that a decree had been signed by Judge Woods, ordering the road to be turned over to Mr. Balch and his associates, the purchasers from Gov. Lewis under the former decree, and that upon compliance with the terms the title to the road be vested in them subject to the first-mortgage lien and such other liens as the court may decree to be valid upon the road.

"We understand that Mr. Balch will take possession at once, and that immediately thereafter contracts will be made for restocking the road and putting it in first-class order in every respect."

Wayahoga Valley.

The directors met in Canton, O., June 29, to make the final location of the line from Canton south by east to Bowersburg on the Pittsburgh, Cincinnati & St. Louis, a distance of about 30 miles.

Chippewa Falls & Western.

The people of Chippewa Falls, Wis., having voted \$25,000 for this road, work is to be commenced at once on the section of 12 miles from Chippewa Falls south by west to the West Wisconsin at Eau Claire. Contracts for grading will be let as soon as the surveys are finished. It is understood that the West Wisconsin Company will iron and operate the road.

Michigan & Ohio.

Meetings are being held on the line of this projected road in

Michigan, and efforts are being made to secure subscriptions to the stock. It is to extend from Grand Haven, Mich., southwest about 400 miles to Portsmouth, O.

Palisade & Eureka.

Track is laid for 20 miles south from Palisade, Nev., the junction with the Central Pacific. The passenger cars have arrived at Palisade, and a passenger train will shortly be put on to run to the end of the completed section.

Gilmore & Salisbury have sold their interest in the road to W. L. Pritchard.

St. Paul & Pacific.

The act extending the time for the completion of this company's lines, which was passed by Congress just at the close of the session, puts the time for their final completion forward to March 3, 1876. It is provided that the rights of all actual settlers who entered upon any of the lands in good faith previous to the passage of the act, shall be reserved to them, or their grantees. The company must file with the Department of the Interior a written acceptance of the conditions of the act.

Buffalo & Jamestown.

The road is now completed to Gowanda, N. Y., three miles south of the late terminus at Lawton's, and 31 miles from Buffalo.

Western Maryland.

The Commissioners of Finance of the City of Baltimore, under authority of a resolution of the City Council authorizing an investment of funds in the securities of this company, have resolved to purchase at par coupons of unendorsed bonds due July 1. They can be presented at the office of the City Register, Baltimore.

The Minnesota Railroad Law.

The Minnesota Railroad Commissioners have established rates of passenger fares for the different lines in the State under the law passed this spring. The rates are as follows: 5 cents per mile, St. Louis & Pacific, Northern Pacific; 4 $\frac{1}{2}$ cents per mile, St. Paul & Pacific, First Division, St. Paul & Sioux City, Sioux City & St. Paul, Minneapolis & St. Louis, Minneapolis & Duluth, Southern Minnesota, Chicago, Dubuque & Minnesota, West Wisconsin; 4 $\frac{1}{2}$ cents, St. Paul, Stillwater & Taylor's Falls, Hastings & Dakota; 4 cents, Lake Superior & Mississippi, Winona & St. Peter, Milwaukee & St. Paul, Iowa & Minnesota Division; 3 $\frac{1}{2}$ cents, Milwaukee & St. Paul, River Division.

The St. Paul & Sioux City Company protests that while it accepts the 4 $\frac{1}{2}$ cents per mile rate for its own road, yet on the Sioux City & St. Paul road, which it operates, the actual expense for carrying passengers the past year has been about 6 cents per mile. If the reduced rate is enforced it must give up the present passenger trains and furnish only such accommodation as can be afforded for the lower rate.

Eric.

A suit has been commenced by John C. Angell, a holder of preferred stock and bonds of the company. He asks that the present officers be enjoined from exercising any control over the company's affairs, that a special receiver may be appointed to take possession of the road, and that the officers may be compelled to account for their management of the company. The grounds of the complaint are that the payment of a dividend on the common stock before full dividends were paid on the preferred stock was illegal; that improper purchases were made of Buffalo, New York & Erie stock; that the money of the company was unlawfully used to purchase coal lands and the title to such lands was not vested in the company, but in the President, Mr. Watson; lastly, that the new \$30,000,000 mortgage is illegal, as no notice was given beforehand and the consent of the stockholders was not obtained.

It is reported that Jay Gould is the real originator of the suit commenced against the company. It is proposed to commence a counter-suit to recover from Gould some \$1,500,000 which, it is alleged, he still owes the company.

Notice is given that the Second Vice-President with the General Freight and Passenger Agents will shortly make a trip over the road, stopping a short time at each station. The object is to discuss passenger and freight rates with the customers of the road, to consider the commercial relations of the road to its customers, and to listen to any complaints that may be made with a view to remove misunderstandings and, as far as possible, causes of complaint. It is evident that such a trip, if the programme presented is carried out, may be productive of much good.

Mississippi Central.

A special meeting of the stockholders was held at Water Valley, Miss., July 1, and it was voted by a large majority to ratify the agreement of consolidation with the New Orleans, Jackson and Great Northern. The consolidated company is to be called the New Orleans, St. Louis & Chicago. The issue of consolidated stock is to be at the rate of one share for three of Mississippi Central and two shares for three of New Orleans, Jackson & Great Northern.

The consolidated company will own a line from New Orleans, La., northward to the Mississippi River opposite Cairo, Ill., 545 miles long, with a branch 21 miles long from Durant to Kosciusko, 566 miles in all. By the last reports of the two companies the stock and debt of the consolidated corporation will be as follows:

Stock (\$8,777 per mile)..... \$4,967,845
Funded debt—

New Orleans, Jackson & Great Northern..... \$8,000,000
Mississippi Central..... \$8,000,000

Total funded debt (\$28,269 per mile)..... \$16,000,000

The \$8,000,000 bonds of the Jackson road are what is called the consolidated mortgage, of which \$4,500,000 was to be exchanged for outstanding bonds, the remainder to be used for reducing the floating debt and improving the road. The Mississippi Central bonds are also consolidated mortgage, of which \$3,708,500 had been issued at the last report and the remainder was held to exchange for outstanding bonds and the Tennessee State loan of \$1,279,000. The annual interest charge will be, when the full issue of bonds is made, \$1,120,000, or \$1,979 per mile. The net earnings of the two roads for 1873 were \$1,422,464, or \$3,226 per mile on the mileage then worked, which did not include 104 miles, from Jackson, Tenn., to Cairo, and the 21 miles of the Kosciusko Branch. The gross earnings for the same time were \$8,233,032, or \$7,331 per mile, the operating expenses being 56 per cent.

The two roads have been worked for some years past by the Southern Railroad Association, which has also worked as a branch line the Mississippi & Tennessee road, from Grenada, Miss., northwest to Memphis, Tenn., 100 miles. The latter line will probably continue to be operated as heretofore.

The Iowa Railroad Law.

The law regulating rates, which was passed by the last Legislature, went into effect July 1. It was stated that at the Chicago, Burlington & Quincy and Chicago & Northwestern companies would comply with the law as to freight rates, but would continue to charge the old rates for passengers. The Illinois Central opposed the law on its Iowa lines. Mr. Ridgeway, Vice-President of the Chicago, Rock Island & Pacific, has written a long letter to the Governor, in which, after reviewing the law, he says that the company intends to conform to it, not believing that the result will be satisfactory, but convinced that it is best to try the experiment. In justice to the

stockholders, however, for whom the officers are simply trustees, rates on inter-State traffic will be so adjusted as to secure from the entire property of the company the revenue to which it is entitled. If it shall prove that the working of the law results practically in total or partial confiscation, then a different policy will be adopted, and any attempt to enforce the law will be resisted in the proper tribunals.

New York Central & Hudson River.

In the suit of this company to recover taxes paid on the scrip certificates as dividend, in the United States Circuit Court at Canandaigua, N. Y., July 1, Judge Wallace directed the jury to bring in a verdict for the company, on the ground that interest certificates are not taxable. An appeal is to be taken to the Supreme Court.

North Pacific Coast.

The track is laid and the road in running order for five miles northward from Sausalito, Cal.

New Orleans, Mobile & Texas.

In the suit brought by the State of Louisiana against this company the Superior District Court has given judgment for the State and ordered the company to return to the State \$750,000 of bonds dated July 1, 1870, with coupons attached, or to pay the amount in money, with interest. By the decision the State is given the first lien on all the company's property west of Mississippi.

Peachbottom.

The completed portion of this road, from Oxford, Pa., to Dallastown, seven miles, was opened for business July 1.

Paducah & Memphis.

The Chancellor's decision has been modified, owing to the act passed last Winter by the Tennessee Legislature authorizing the consolidation of the Paducah & Gulf and Mississippi River Railroad companies, so that contracts made by the company are not declared invalid as at first reported.

The Railway Association of America.

The following circular has been issued by the Executive Committee of the Association:

St. Louis, June 15.

SIR—I am directed by the Executive Committee of the Railway Association of America to lay before you the accompanying revised constitution, and to invite your company to become a member of the Association.

The objects and purposes of this Association as laid down in the constitution, are:

1. The improvement of railroad management by fostering a study of its principles and details.

2. To collect and publish statistics, reports and papers relating to railroad economy.

3. To establish a library wherein shall be collected all published works and all accessible information concerning railway management, and the economic relations of railways.

4. To provide a means of ascertaining the views and desires of the body of railway managers on any point that may be raised by a member, without the necessity of having recourse to a general convention.

5. To maintain an office in which may be preserved records of general and other conventions, and through which a convention may be readily called, when necessary, to discuss any subject of common interest to the members of the Association.

6. To take such action as may lead to greater efficiency and economy in the operation of railways, and as shall tend to systematize the efforts made in that direction.

The annual contribution of each company member of the association is fixed at ten cents per mile operated. No other assessment will be made without general consent. The Executive Committee desire me to say, further, that if a sufficient number of railway companies become members of the association, under the revised constitution, to warrant such a step, it is their purpose to issue quarterly to members a journal containing such original articles as may be contributed by railway officers and others interested in the discussion of matters pertaining to railway economy, such statistics as can be obtained from authority, and reprints from such papers, reports of discussions, etc., as may have appeared elsewhere. The scope of this journal is to be confined to the transportation and general management departments. By this means will be gathered in a form convenient for reference all the contributions of experience and the discussions of railway matters which are scattered so widely in various publications, and much of which is either inaccessible to, or does not come under the notice of, the body of railway officers.

The Executive Committee believe that the publication of such a journal is the best means of encouraging that study of professional matters, and facilitating that communication of ideas between the students, and that comparison of experiences which is essential to rapid progress, and which it is the interest of railway companies to promote.

Under article 3 of the constitution any company operating a railway shall become a member on application in writing to the Secretary.

By order of the Executive Committee.

HARRY E. SHARK, Corresponding Secretary.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

Report of the Committee on the Form, Endurance and Manufacture of Rails.

The members of the committee (or such of them as have been able to meet together) appointed to investigate and report upon the forms, sizes, manufacture, tests, endurance and breakage of rails, and also the comparative economy of steel and iron rails, have given attention to the subject, and issued circular interrogatories* to obtain the results of American experience. They have not, however, as yet received a sufficient number of responses to warrant a final report, or to give full numerical results, on a subject so extensive, so important, and in some respects so unsettled. This they hope to do at the next annual meeting of the society, and accordingly urgently repeat their requests for answers to their interrogatories.

There are some points, however, on which experience has enabled them to form opinions so decided that they now submit them to the Society. Members can compare these with facts within their own knowledge; and the committee, on hearing from them, will, if such facts require it, modify their opinions in the final report.

Before entering upon the particular points on which the committee is to report, it will be proper to present some general considerations bearing upon all of them.

A rail has two principal functions or classes of functions, acting as a beam or girder, to carry the heaviest weights between the most distant *actual* supports without straining the metal beyond the limits of its elasticity, and to distribute the weight bearing on one point of the rail among the adjacent supports. The first part of this function requires strength, the second stiffness. The second class of functions or duties of the rail is to resist crushing and to endure the wear. The first of those requires hardness and breadth of surface, the

*Page 71 of this volume of the RAILROAD GAZETTE, February 1874.